# SAPIA South Africa National Oil Spill Capability Review

SAPIA

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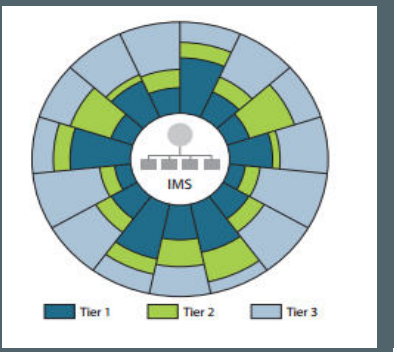


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## Abbreviation List

| | |
|---|---|
| ALARP | As Low As Reasonably Practicable |
| AMSOL | African Marine Solutions |
| ARPEL | Regional Association of Oil, Gas and Biofuels Sectors Companies in Latin America and the Caribbean |
| CBM | Conventional Buoy Mooring |
| C&R | At Sea Containment and Recovery |
| CLC | Civil Liability Convention |
| DEFF | Department for Environment Forestry and Fisheries |
| DoT | Department of Transport |
| GIWACAF | The Global Initiative for West, Central and Southern Africa |
| $H_2S$ | Hydrogen Sulphide |
| HFO | Heavy Fuel Oil |
| IFO | Intermediate Fuel oil |
| IMO | International Maritime Organisation |
| IMS | Incident Management System |
| IOGP | International Association of Oil and Gas Producers |
| IPIECA | International Petroleum Industry Environmental Conservation Association |
| ITOPF | International Tanker Owners Pollution Federation |
| IV | Island View |
| JBS | Joint Bunkering Service |
| LR | Long Range |
| MARPOL | Marine Pollution Act |
| MFO | Marine Fuel Oil |
| MGO | Marine Gas Oil |
| NDMC | National Disaster Management Centre |
| NEBA | Net Environmental Benefit Analysis |
| NEMA | National Environmental Management Act |
| NOSCP | National Oil Spill Contingency Plan |
| OPCSA | Oil Pollution Control South Africa |
| OPRC | International Convention on Oil Pollution Preparedness |
| OSCP | Oil Spill Contingency Plan |
| OSRL | Oil Spill Response Ltd |
| OWR | Oiled Wildlife Response |
| SAMSA | South African Maritime Safety Authority |
| SAPIA | South African Petroleum Industries Association |
| SANCCOB | Southern African Foundation for the Conservation of Coastal Birds |
| SBM | Single Buoy Mooring |
| SCAT | Shoreline Clean-up Assessment Technique |
| SG | Specific Gravity |
| SPCA | Society for the Prevention of Cruelty to Animals |
| SOPEP | Shipboard Oil Pollution Emergency Plan |
| TNPA | Transnet National Ports Authority |
| TPR | Tiered Preparedness and Response |
| TUE | Twenty-foot equivalent units |
| UAV | Unmanned Aerial Vehicles |

| | |
|---|---|
| V&A | Victoria & Alfred Waterfront |
| VLCC | Very Large Crude Carriers |
| VOO | Vessel of Opportunity |
| VTS | Vessel Tracking System |

# Executive Summary

South African Petroleum Industries Association (SAPIA) has contracted Oil Spill Response Ltd (OSRL) to review South Africa's current national oil spill preparedness levels through an oil spill capability review. The capability review covered twelve organisations at eight sites in South Africa for both industry and government (including Transnet Port Authority (TNPA)). This review covers operations that have a risk of oil spill to water.

This gap analysis was completed between July and December 2019. The worst credible risks identified are:

- Tanker inside a port grounding / collision with loss of oil from storage tanks. Expected worst case loss of 100 000 $m^3$ of crude oil.
- Tanker place of refuge for damaged tanker, with loss of oil from storage tanks. Expected worst case loss of 100 000 $m^3$ Expected worst case loss of 100 000 $m^3$ of crude oil.
- Bunkering tanker in Algoa Bay grounding / collision with loss of oil from storage tanks. Expected worst case loss of 6 600 $m^3$ of crude oil.
- Tanker at Durban SBM fire on approach to berthing at the SBM resulting in total loss of oil tanker's cargo. Expected worst case loss of 318 000 $m^3$ of Crude oil, IFO or MGO.
- Storage tank loss from primary containment at Island View, Durban. Expected worst case loss of 10 000 $m^3$ to sea.

A key part of the capability review is the gap analysis, which ensures that investment in oil spill capability meets the needs of the operation and risk. Recommendations are made based on risk reduction, legislation and international good practice. The focus of the current project has been to identify those areas where gaps in preparedness have been identified as opposed to flagging where full compliance exists i.e. no gap exists. Gaps in preparedness are defined as either minor, moderate or major and a summary of the major (high priority) recommendations are summarised below in Table 1.

**Table 1 Summary of Major Gaps Identified**

| Gaps Summary | Recommendation Summary |
|---|---|
| Legislation, Regulations and Agreements | |
| National Dispersant Policy (in draft)- No published list of approved dispersants or clear explanation of which dispersants would be allowed. | Make wording clearer in the policy for how to establish if a dispersant is approved for use i.e. listed on 2 of 3 country approved lists, make reference to the websites these up-to-date lists can be sourced from. This is the responsibility of DEFF. |
| National Dispersant Policy (in draft)- The highest risk coastal crude spill is at the Durban SBM which is outside allowed dispersant spray areas according to restrictions in the draft dispersant policy. | DEFF to document a clear process for pre-approval (prior to an oil spill) to explain how an operation location/area that falls outside of the dispersant usage guidelines can apply for approval to use dispersant and what the timescales for approval are. |
| Tiered Preparedness and Response Capability | |
| Response Responsibility - Not clear who would respond (in terms of in-field responders) to an oil spill response for a large-scale incident offshore. | Ensure that at sea resources and enough hands on personnel are available in a large scale incident. |
| Dispersant - No useable dispersant, or trained responders are available nationally. | Arrange dispersant stocks, guaranteed access spray equipment and trained operators at strategic points on the South African coastline. A maintenance programme then needs to be put in place to maintain this equipment. |

| | |
|---|---|
| Aerial surveillance - No trained aerial surveillance observers. | At a national level, trained aerial surveillance responders should be available and on call. |
| Equipment and Tiered Response Capability | |
| Equipment commissioning - lack of commissioning of oil spill response equipment. | All oil spill providers should have response ready equipment that is commissioned, has all ancillaries stored, maintained and exercised. |
| Equipment maintenance and storage - lack of maintenance of some TNPA and DEFF oil spill response equipment. | All DEFF and TNPA equipment to be maintained regularly. Maintenance program for DEFF equipment was not checked/available at the time of the visit. Equipment awaiting decommissioning should be clearly marked so it is clear what equipment is available for deployment. |
| Equipment maintenance and storage – inadequate storage of DEFF oil spill response equipment. | Equipment move to be completed. Appropriate racked and labelled storage to be arranged. All equipment to be itemised and status of equipment to be recorded – where equipment is awaiting decommissioning this should be clearly marked. Equipment should be stored with ancillaries required for ease of deployment. |
| Vessel availability - vessels should be available quickly for pollution response. | Have either dedicated vessels for spill response and/or vessels that have another day-to-day function but are available to be called upon and be dedicated to this role. |
| Other Observations | |
| Safety - portable gas monitors were not seen in most response equipment stockpiles across the ports. | Have suitable portable gas monitors for all response teams who may need to respond. |
| Safety - TNPA and DEFF facilities had no visible written procedures on how to operate equipment. | Oil spill equipment owners should arrange work instructions for any mechanical equipment they hold. |
| Safety - DEFF equipment stockpiles contained equipment with hydraulic hoses that had exceeded their testing and/or replacement dates. | Equipment that is to be used should be well maintained to ensure safety. Implement a maintenance program for all equipment that includes hydraulic lose testing/replacement. |

Details of moderate and minor gaps are provided in the Gap Analysis Section 6.5 (p. 59 onwards). The gap classification definitions are provided in Table 2 of this report.

# 1. Introduction

The South African Petroleum Industry Association (SAPIA) requested Oil Spill Response Limited (OSRL) to provide a comprehensive audit of South Africa's current national oil spill preparedness levels through the delivery of an oil spill capability review.

The capability review was designed to assess South Africa's current national oil spill preparedness levels and discern whether it meets the needs of the current operations, legislation and oil spill risks. This included assessing industry and government oil spill response equipment, competence and capability to response to a Tier 2 oil spill incident with the potential of escalation to a Tier 3 incident. As part of this review, the following companies were assessed at the following sites in late July/early August 2019, and the gaps identified in this review represent the situation observed at the time of visit:

1. Saldanha Transnet Port Authority (TNPA), Oil Pollution Control of South Africa (OPSCA) and Astron Energy
2. Cape Town – TNPA
3. Cape Town Joint Bunkering Services
4. Mossel Bay – TNPA (supporting SPM/CBM facilities), Petro SA, Shell
5. Port Elizabeth – TNPA, Shell (Dom Pedro)
6. Port of Ngqura (Coega)
7. East London – TNPA, Engen, Buffalo City Municipality
8. Durban – TNPA, SAPREF, Island View (i.e. Cutler Complex), Blencor, JBS Facility (total 1 facility)
9. Richards Bay Bunkering Services

There are many parts to be considered when developing an in depth and robust oil spill response system. OSRL has over 30 years of hands-on spill response and integrated preparedness planning experience. OSRL has incorporated guidance from key industry organisations to review each key element of South Africa's oil spill preparedness and response capability to provide recommendations to enhance their oil spill response preparedness.

The organisations include:

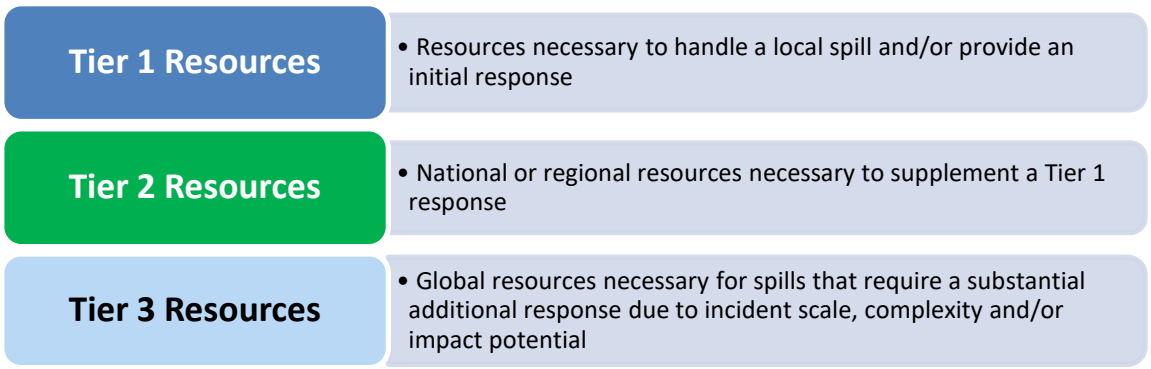
- The International Tanker Owners Pollution Federation Ltd (ITOPF),
- The Regional Association of Oil, Gas and Biofuels Sectors Companies in Latin America and the Caribbean (ARPEL)[1] ,
- The global oil and gas industry association for environmental and social issues (IPIECA) and,
- The International Association of Oil and Gas Producers (IOGP)[2]

## 1.1. Tiered Preparedness

The Tiered Preparedness and Response (TPR) principle is used in this gap analysis to categorize and structure levels of oil spill response capability to allow for response escalation. The definitions used are consistent with

[1] ARPEL Oil Spill Response Planning and Readiness Manual (v 2.0) 2014
[2] IPIECA IOGP Joint Industry Project (JIP) Good Practise Guide for Tiered Preparedness and Response: http://oilspillresponseproject.org/sites/default/files/uploads/tpr-glance-scan-product_9-19-14.pdf

the IPIECA/IOGP tiered preparedness and response good practice guide[3]. This principle is explained in more detail in Section 7.5 (page 67).




Due to the nature of this definition whereby all on-site resources have been classified as Tier 1, note that Tier 1 resources are not necessarily under the direct control of Operators. This review focussed on Tier 1 and 2 gaps rather than Tier 3.

Tiered resources differ between downstream industry operators and the shipping industry. For the downstream industry, Tier 1 resources are those within the operator's facility or available from a contracted service provider.

For shipping related spills, a greater reliance would be made on Tier 2 resources (unless the spill is related to a South African operator who would support with Tier 1 resources) as ships would only hold resources to deal with very minor scale spills.

The capability reviews for each operator have:

- created and used planning scenarios to indicate the level of oil spill risk that could arise from each operators/joint venture operations in South Africa;
- assessed oil spill response resources available in each of the 7 main Ports around South Africa where each operator is based;
- assessed compliance of current oil spill activities to South African oil spill guidance and typical good industry practice; and
- assessed completeness and currency of existing emergency response documents to suit the current operations.

The tiered level assessment is used to confirm the severity of an oil spill and the level of response required. A pre-defined tiered capability provides a structure for the appropriate level of response to an incident.

**Aims**

This oil spill capability review aims to identify gaps in the national oil spill response readiness and capability of South Africa and offer recommendations to bring it in line with industry good practice.

**Methodology**

The national oil spill risk profile is required to effectively assess oil spill preparedness. This information was collected and discussed with SAPIA stakeholders and government organisations during the site visits.

[3] IPIECA/IOGP Tiered preparedness and response: Good practice guidelines for using the tiered preparedness and response framework revision 2016

Recommendations are given corresponding to the risk, the availability of Tier 1 and Tier 2 response options and in accordance with legislative requirements and international good practice. Each recommendation is based on an observation. It has been assigned a level of priority based on the following definitions in Table 2:

**Table 2 Gap Classification Definition**

| Gap Classification | Definition |
|---|---|
| **Major** | • No conformance with industry good practice,<br>• Not defined,<br>• No indicator of implementation in place,<br>• Non-compliance to local legislation. |
| **Moderate** | • Little conformance with industry good practice,<br>• Partially defined,<br>• Example indicators of implementation partially identified but there are gaps that may impact implementation/delivery,<br>• There are no systematic processes in place to maintain conformance. |
| **Minor** | • Partial conformance with industry good practice,<br>• Largely defined,<br>• Example indicators of implementation identified with systematic process in place to implement/deliver the requirements,<br>• Well understood and practiced, with clear accountabilities and defined competencies,<br>• A monitoring process/procedure to control and verify conformance to the requirement over time is identified but not yet fully implemented/practiced. |
| **No Gap / Full Conformance** | • Full conformance with industry good practice,<br>• Clearly defined,<br>• Example indicators of implementation identified with systematic process in place to implement/deliver the requirements,<br>• Well understood and practiced, with clear accountabilities and defined competencies,<br>• A monitoring process/procedure to control and verify conformance to the requirement over time is in place and well-practiced. |

It is acknowledged that not all recommended changes can be made at once and not all can be or will need to be made immediately. A gradual process of change is suggested based on the gap classification rating.

**Note:** These recommendations are a guide. Improvements and measures will require agreement and collaboration between industry operators and government authorities. It is at the discretion of the authorities and operators which recommendations to implement, when to make changes and to what extent.

## 2. Legislation and National Guidance

In summary, for the maritime and coastal areas outside harbours the organisations responsible are as follows:

- The Competent authority
    - The Department of Transport (DoT) is responsible for making sure the appropriate actions are taken to minimise the effect of releases of harmful substances (e.g. oil) from ships, tankers or offshore installations. The Marine Pollution Control and Civil Liability Act 6 of 1981 is administered by the DoT, the combating of at sea oil pollution was assigned to the then Minister of Environmental Affairs and Tourism (now Department of Environment, Forestry and Fisheries, DEFF). Many of the administrative functions were transferred to the South African Maritime Safety Authority (SAMSA) in 1998. Any oil marine oil spills and shipping incidents must be reported to SAMSA. SAMSA would then coordinate or advise on the appropriate response and will alert the appropriate responders.
    - Within the 2017 version of the South African Comprehensive Maritime Transport Policy, it lists the DoT, in co-operation with other Departments and agencies, responsible for maintaining a comprehensive Contingency Plan to ensure compliance with the provisions of the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC).
- Response
    - SAMSA is responsible for overall co-ordination of the prevention and/or combating of an oil spill incident[4]. If a ship is in distress, casualty response and salvage are under SAMSA's responsibility. Their powers include requiring the master or owner of a ship or tanker to unload the harmful substance from the ship or tanker, to dispose of any harmful substance unloaded or to move the ship or tanker to a place specified by SAMSA (place of refuge). Other relevant responsibilities include administering the acts relating to oil pollution, taking control of the technical aspects of shipping casualties and controlling the use of the standby oil pollution prevention tug, contracted from African Marine Solutions (AMSOL).
    - DEFF has responsibility for combating pollution of the sea and shoreline by oil (as delegated under Section 52 of the SAMSA Act 5 of 1998) and is the overall coordinator of clean-up operations. DEFF is responsible for co-ordination and implementation of coastal environmental protection and clean-up, control of the use of pollution combating vessels, surveillance aircraft, dispersants and dispersant spraying operations, maintenance and supply of dispersant stocks and other dedicated oil spill equipment. DEFF will liaise with different groups (including local environmental groups, SAMSA and salvors). DEFF compiled 24 local coastal oil spill contingency plans that detail appropriate actions to be taken upon threatened or actual impact.
    - Local authorities are responsible for taking specified measures to prevent or remedy adverse effects of a spill on the coastal environment, provide assistance in the form of supervision, labour, transport and equipment for the protection and clean-up of their beaches and other areas under their jurisdiction, making arrangement with local Traffic and Police.
- Harbour Masters
    - One of TNPA's functions is to regulate and control pollution and protect the environment within the port limits. They have jurisdiction over their individual port areas which typically stretch 3-5 miles from the main harbour port areas.

[4] Department Environmental Affairs Republic of South Africa, Coastal Oil Spill Contingency Plan, 2010

## 2.1. Legislation

### 2.1.1 International Legislation

There is various international and national legislation that South Africa has adopted. Table 3 shows a summary of the international conventions South Africa has signed up to.

**Table 3 International Conventions and Agreements (GIWACAF, 2017)**

| **International Conventions** | |
|---|---|
| OPRC'90 | • International framework for cooperation in combating and responding to major incidents or threats of oil pollution.<br>• The convention strives to:<br>o Prevent marine pollution by oil, in accordance with the precautionary principle<br>o Advance the adoption of adequate response measures if oil pollution does occur<br>o Provide for mutual assistance and co-operation between States for these aims<br>• Parties adhering to the convention are required to establish:<br>o Measures for dealing with pollution incidents, either nationally or at a regional and global level, in co-operation with other countries.<br>o Stockpiles of oil spill response equipment for oil spill response exercise and the development of detailed pollution incident response plans.<br>o Oil pollution emergency plans for ships, offshore units and seaports under their jurisdiction. |
| MARPOL 73/78 | • Prohibits the discharge of oil or oily mixtures from ships into the sea, except where '*the oil content of the effluent without dilution does not exceed 15 parts per million*'.<br>• Allowance for oil spill operations for '*the discharge into the sea of substances containing oil, approved by the Administration, when being used for the purpose of combating specific pollution incidents in order to minimize the damage from pollution. Any such discharge shall be subject to the approval of any Government in whose jurisdiction it is contemplated the discharge will occur*.'<br>o Local regulation and guidance should always be sought prior to carrying out any decanting operations.<br>• Requires ships to have a Shipboard Oil Pollution Emergency Plan (SOPEP), in accordance with IMO guidelines and approved by the government of the state under whose authority the ship is operating.<br>• The SOPEP must include:<br>o Procedures for reporting oil pollution incidents<br>o List of authorities and persons to be contacted in an incident<br>o Detailed description of immediate action to be taken to reduce or control discharge of oil<br>o Procedures and point of contact for co-ordinating spill response actions with national and local authorities |
| CLC 1992 and Fund 2003 | • Convention on Civil Liability for Oil Pollution Damage<br>• Ensures adequate compensation is available to persons who suffer oil pollution damage resulting from oil-carrying ships.<br>• Covers oil spill from ships but does not cover oil spills from offshore installations, drilling facilities or inland spills. |

### 2.1.2 National Legislation

The main national legislation that relates to pollution and response is listed below.

**Marine Pollution Control and Civil Liability Act 6 of 1981**

This Act provides for the protection of the marine environment from pollution by oil and other harmful substances. The Act provides for criminal and civil liability following a discharge which causes pollution into the sea.

The DoT is responsible for making sure the appropriate actions are taken to minimise the effect of releases of harmful substances (e.g. oil) from ships, tankers or offshore installations. While the Act is administered by the DoT, the combating of at sea oil pollution was assigned to the then Minister of Environmental Affairs and Tourism (now Department of Environment, Forestry and Fisheries, DEFF).

Many of the administrative functions were transferred to the SAMSA in 1998. The Act gives SAMSA extensive powers to prevent pollution of the sea where a harmful substance (e.g. oil) is likely to or is being discharged from ships, tankers or offshore installations. Such powers include requiring the master or owner of a ship or tanker to unload the harmful substance from the ship or tanker, to dispose of any harmful substance unloaded or to move the ship or tanker to a place specified by SAMSA.

The owner of any ship, tanker or offshore installation shall be liable for any loss or damage caused in the area of South Africa by pollution resulting in the discharge of oil. They will also be liable for the cost of any measures taken by SAMSA after an incident has occurred for the purposes of reducing loss or damage caused or any loss or damage caused by measures taken after a discharge has occurred.

**Marine Pollution Act (Prevention and pollution) Act 2 of 1986 (MARPOL).**

The MARPOL Act gives effect to the MARPOL Convention, by providing for the protection of the sea from pollution by oil and other harmful substances discharged from ships. This Act is administered by the DoT.

The Act provides for the Minister to make regulations to give effect to the provisions of the Convention. This includes the Minister making regulations to exempt certain classes of ships from the provisions of the Convention so South Africa is not entirely restricted by the provisions of the Convention.

**South African Maritime Safety Authority Act No. 5 of 1998**

This Act provides for the formation of SAMSA whose objectives are to ensure the safety of life and property at sea, to prevent and combat pollution of the marine environment by ships and to promote South Africa's maritime interests. SAMSA may perform a function itself, in co-operation with another person or by delegating or assigning the power or duty concerned.

**National Ports Act, 2005 Act No. 12 of 2005**

The main functions of the TNPA are to own, manage, control and administer ports to ensure their efficient and economic functioning. This includes regulating and controlling pollution and the protection of the environment within the port limits.

**National Environmental Management Act (NEMA) 107 of 1998:**

NEMA is administered by the DEA now DEFF and provides for cooperative environmental governance by establishing principles for decision-making on matters affecting the environment.

Oils spills are ordinarily dealt with as emergency incidents under section 30 of NEMA and section 30 defines an incident as an unexpected, sudden and uncontrolled release of a hazardous substance, including from a major emission, fire or explosion, that causes, has caused or may cause significant harm to the environment, human life or property.

Under this Act, the costs of remedying pollution, environmental degradation and consequent adverse health effects, and controlling further pollution, environmental damage or adverse health effects must be paid for by those persons responsible for harming the environment.

Section 30 of NEMA is relevant to oil spills as it deals with the control of emergency incidents. The responsible party must as soon as reasonably practicable after knowledge of the incident, take all reasonable measures to contain and minimize the effects of the incident, undertake clean up procedures, remedy the effects of the incident and assess the immediate and long-term effects of the incident on the environment and public health.

**National Disaster Management Act, Act No.57 of 2002**

This Act provides for, among others, an integrated and co-ordinated disaster management policy that focuses on preventing or reducing the risks of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery.

Section 27 of the Act states that the Minister in the event of a national disaster, by notice in the Gazette, may declare a national state of disaster if the existing legislation and contingency arrangements do not adequately provide for the national executive to deal effectively with the disaster or if other special circumstances warrant the declaration of a national state of disaster.

## 2.2. National Plan and Guidance

**South Africa's National Oil Spill Contingency Plan (NOSCP) Maritime (adopted on October 31, 2018)**

The NOSCP aims to promote the planned and nationally co-ordinated response to any marine oil spill to:

a. protect human health and safety;

b. minimise detrimental environmental impacts; and

c. provide for the restoration of the environment, as nearly as is practicable, to pre-spill conditions.

The NOSCP sets out the roles and responsibilities of most parties likely to be involved in a national response to a marine oil spill in South Africa.

Under the Marine Pollution (Control and Civil Liability) Act 6 of 1981, the DoT is responsible for responding to a national marine oil spill incident. Under the Maritime Safety Authority Act 5 of 1998, SAMSA administers these responsibilities.

The priorities for response identified in the NOSCP are:

a. human health and safety;

b. natural environment;

c. commercial resources;

d. amenities; and

e. reputation.

The NOSCP states that a Net Environmental Benefit Analysis (NEBA) will be used to decide which response techniques to use.

If an oil spill occurs the incident owner should activate their own Oil Spill Contingency Plan (OSCP) and notify SAMSA. If the incident owner cannot deal with the incident it would then be handed over to the national maritime incident management (IM) structure. Should the national maritime IM structure not be able to cope with an incident, they would then approach the National Disaster Management Centre (NDMC) to assist.

The NDMC is established as an institution within the public service and forms part of, and functions within a department of state where the Minister is responsible. Their objective is to promote an integrated and co-ordinated system of disaster management, with special emphasis on prevention and mitigation by national,

provincial and municipal organs of state, statutory functionaries, other role players involved in disaster management and communities.

**The Draft Policy on the Use of Oil Spill Dispersant in South African Waters. Written by the DEA (now DEFF), 2016**

The draft policy was published in 2016 and is subject to change. It contains different sections on the dispersant use and approval process, such as:

- A description of how dispersants work, their advantages and disadvantages.
- How dispersant types will be approved. DEFF would consider products which have been approved/certified under the dispersant approval process of the UK, USA, France and Australia. DEFF recommend that anyone wanting to use a dispersant verify with the department that the dispersant meets the criteria of being certified by these countries or have successfully undergone South Africa's approval process (which has similar standards for toxicity and efficacy testing as UK, France, USA and Australia).
- Restrictions for use. More details in Table 4 below.
- Monitoring requirements. The draft policy stipulates that the DEA (now DEFF) will require monitoring of the effectiveness and efficiency of the dispersant during its use.

**Table 4 Dispersant Use Restriction Summary**

| Water body characteristics | Oil slick characteristics |
|---|---|
| Dispersants should only be used in waters:<br>• more than 3 nautical miles (5.6 km) from land; and<br>• with a depth of more than 20 meters. | Dispersants should not be used on:<br>• slicks ≥ 0.5 cm in thickness;<br>• slicks that appear as solely as sheen or colour bands;<br>• diesel or light fuel oil;<br>• viscous, weathered or emulsified oil; or<br>• oils with pour points close to or above ambient temperature. |

**Implications of the Draft Marine Oil Pollution Bill (31 October 2019)**

The purpose of the Bill is to incorporate the relevant part of the OPRC Convention into South African law.

The objectives of the Bill are:

1. To provide safe, effective and efficient management and deployment of resources in response to and cooperation and control of oil spills or any other pollutant from ships or other sources within South African waters, or which pollute or threaten to pollute South African waters, aquatic recourses, coastline or related interests;
2. To make sure there is effective cooperation with neighbouring countries for marine pollution preparedness, response and control;
3. Incorporate into South African law the relevant parts of international conventions relating to marine pollution preparedness, response and cooperation; and
4. Reduce and control the pollution of the marine environment by oil from ships, offshore installations, seaports and oil handling facilities.

The Bill is divided into 5 main chapters of which the most relevant part for this review is Chapter 2 Marine Pollution Preparedness.

Clause 5 -risk assessments

SAMSA must undertake a national marine pollution risk assessment within one year after the Bill comes into operation, and thereafter at least every five years or whenever there is a substantial new development that may alter the risk of marine pollution incidents affecting South African waters or coastline.

The owner and operator of any port facility, oil facility or offshore installation, must undertake a marine pollution risk assessment for such facility or installation within one year after this Act comes into operation and align with the SAMSA risk assessment.

To ensure standardisation of plans, clause 5(2) provides minimum guidelines that include the identification of routes, quantities as well as frequencies of such assessments.

Clause 6 contingency planning

Clause 6 gives powers to the Minister to prescribe in the regulations, the procedures for development and approval of a National Oil Spill Contingency Plan with greater stakeholder participation.

Clause 7 site specific contingency plans or industry oil spill contingency plans.

Owners or operators of port facilities must develop and maintain site -specific pollution contingency plans or industry oil spill contingency plans which are appropriate to the level and type of risk of marine pollution incidents resulting from their activities and must be consistent with the NOSCP. They must, where applicable, detail measures that must be taken to protect, rescue, rehabilitate and release all wildlife affected in the case of a marine pollution incident.

An owner or operator must ensure that regular training and exercises are undertaken in relation to a site -specific plan and implement any recommendations in a training calendar developed by the National Marine Pollution Preparedness and Response Cooperation Committee.

Clause 8 marine pollution response equipment inventory

SAMSA must establish and maintain a national marine pollution response equipment inventory and also develop training and exercise programmes based on the risks outlined in the risk assessment.

All owners and operators of port facilities, oil facilities or offshore installations which pose a risk of marine pollution incidents must procure, operate and maintain, in a state of constant readiness including personnel that are competent to deploy the pollution response equipment, a stockpile of marine pollution response equipment being appropriate to the level and type of risk of marine pollution incidents resulting from the facility or installation, and being suitable for local conditions.

SAMSA and the private sector, with the advice of the National Marine Pollution Preparedness and Response Cooperation Committee, must jointly develop and agree to a national administrative arrangement as a standard operating procedure for the use of national marine pollution response resources, in respect of both private sector -owned and government -owned equipment and resources, as well as personnel, consistent with the envisaged Act with the Marine Pollution (Control and Civil Liability) Act, 1981(Act No.6 of 1981).

Clause 9 training and exercise

SAMSA must develop and implement an annual programme of training and exercises in marine pollution control and clean -up in respect of the relevant officials from the various government bodies.

The owners and operators of port facilities, oil facilities or offshore installations must develop and implement an annual programme of training and exercises in marine pollution control and clean -up including basic oiled wildlife response, for relevant staff from their organisations. This must be consistent, coordinated and, as far as possible, integrated with the national training and exercise programme

established and the outcomes of such training and exercises must be used to update and improve the owners' and operators' site -specific pollution contingency plans.

# 3. Operations Overview

## 3.1. Shipping

South Africa is positioned on the heavily relied upon the Cape Route and has ships passing around the coast from the Atlantic Ocean to the Indian Ocean with vessels visiting each of the main ports to load/offload.

A study conducted by the DEA[5], looked at reported oil spill incidents along the approximately 3000 km of South African coastline with the aim to generate an oil spill hot spot model to identify areas of risk. Aerial surveillance observations were taken over the period 2008-2013 across the coastline to monitor for oil slicks/spills. The reports were analysed only on spill location and divided into three categories, which were based on the possible source of the spill: wreck (oil entering the water from vessels scuttled/sunk/grounded at sea), slick (oil illegally discharged into the coastal waters of South Africa) and transfer spills (unintentional release of oil into the coastal waters due to an incident or fuel transfer activity).

The results showed a high frequency of illegal slick related discharges along the Agulhas bank off the coast of South Africa. It also showed a high probability of vessel groundings within this area but largely along the South Coast of Southern Africa. The high occurrence of incidences within this area can be attributed to the adverse unpredictable weather conditions and strong currents experienced along the Agulhas bank.

The results show oil spills occurring along the coast of South Africa are clustered spatially, resulting in the formation of oil spill "hot spots". The oil slick data points show a hot spot along the Agulhas Coast and a greater chance than expected normally of an oil slick with smaller grid sizes reveal micro hot spots over the Cape Metro, Sunshine Coast, and Wild Coast respectively. This information gives insight into potential locations that could be impacted and frequency of incidences in the coastal environment however major oil spill incidents have the potential to happen anywhere along the South African coast.

A large percentage of the observed and reported oil spills in South Africa are slick related from vessels discharging into the coastal environment. Other such reports are based on incidence's resulting in oil spills which cannot be subject to deliberate discharges.

Consequently, the risks to environmental impacts on the coast from oil spill hotspots are dependent on the location and its associated bio sensitivity. Furthermore, the physical nature of the shoreline influences the mitigation measure that would be implemented for clean-up if oil incidences were to occur at a specific location.

[5] University of Western Cape and Department of Environmental Affairs, Coastal oil spill hot spot assessment in South African coastal waters: Analysis of aerial surveillance reports and vessel related incident data , 2017

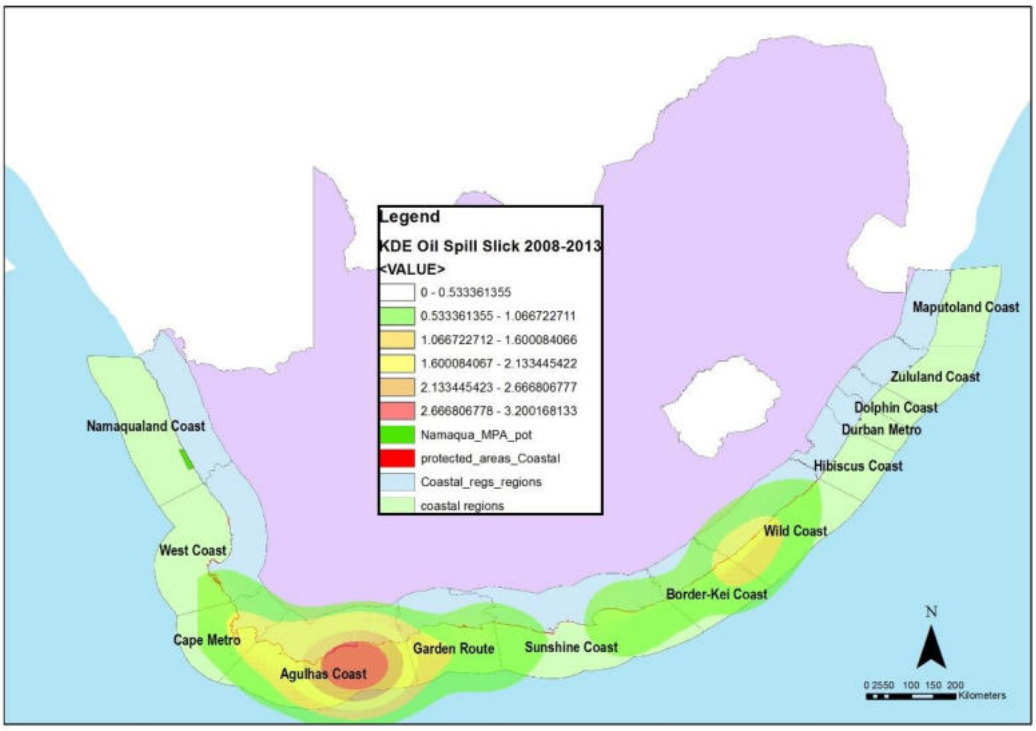



**Figure 1 Oil spill hotspots based on spills data 2008-2013.**

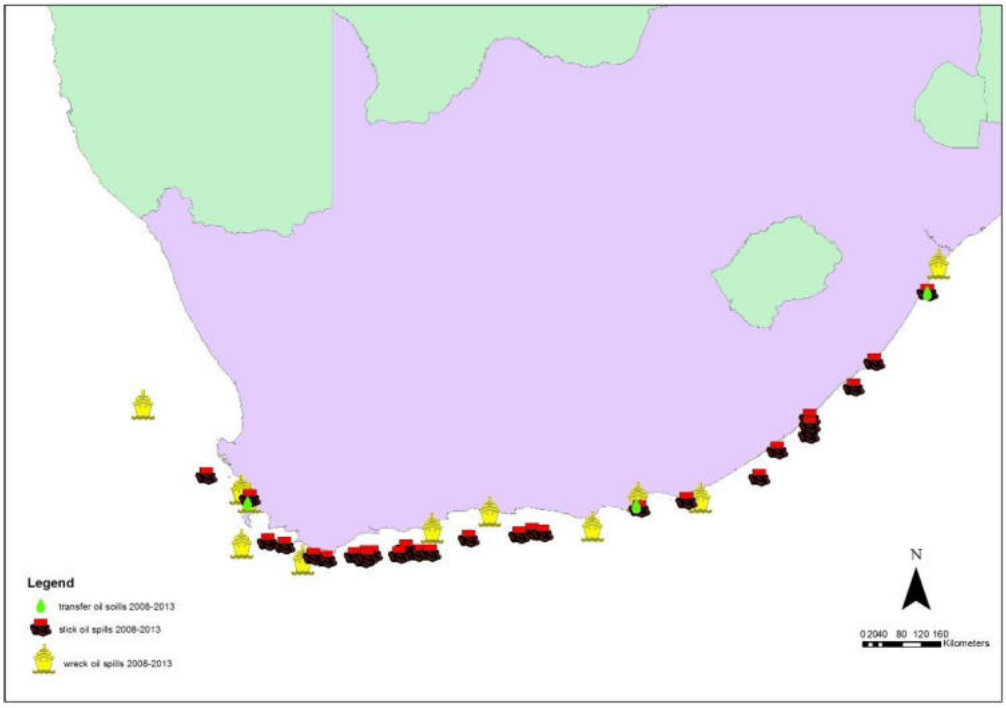



**Figure 2 Location of oil spills from the three categories of spills observed.**

## 3.2. Regional Operations

Eight ports were reviewed as part of this capability review and are as follows:

- Saldanha
- Cape Town
- Mossel Bay
- Port Elizabeth
- Ngqura (Coega)
- East London
- Durban
- Richards Bay

The type of port activities found at each port are shown in Figure 3 and are described in the following sections.

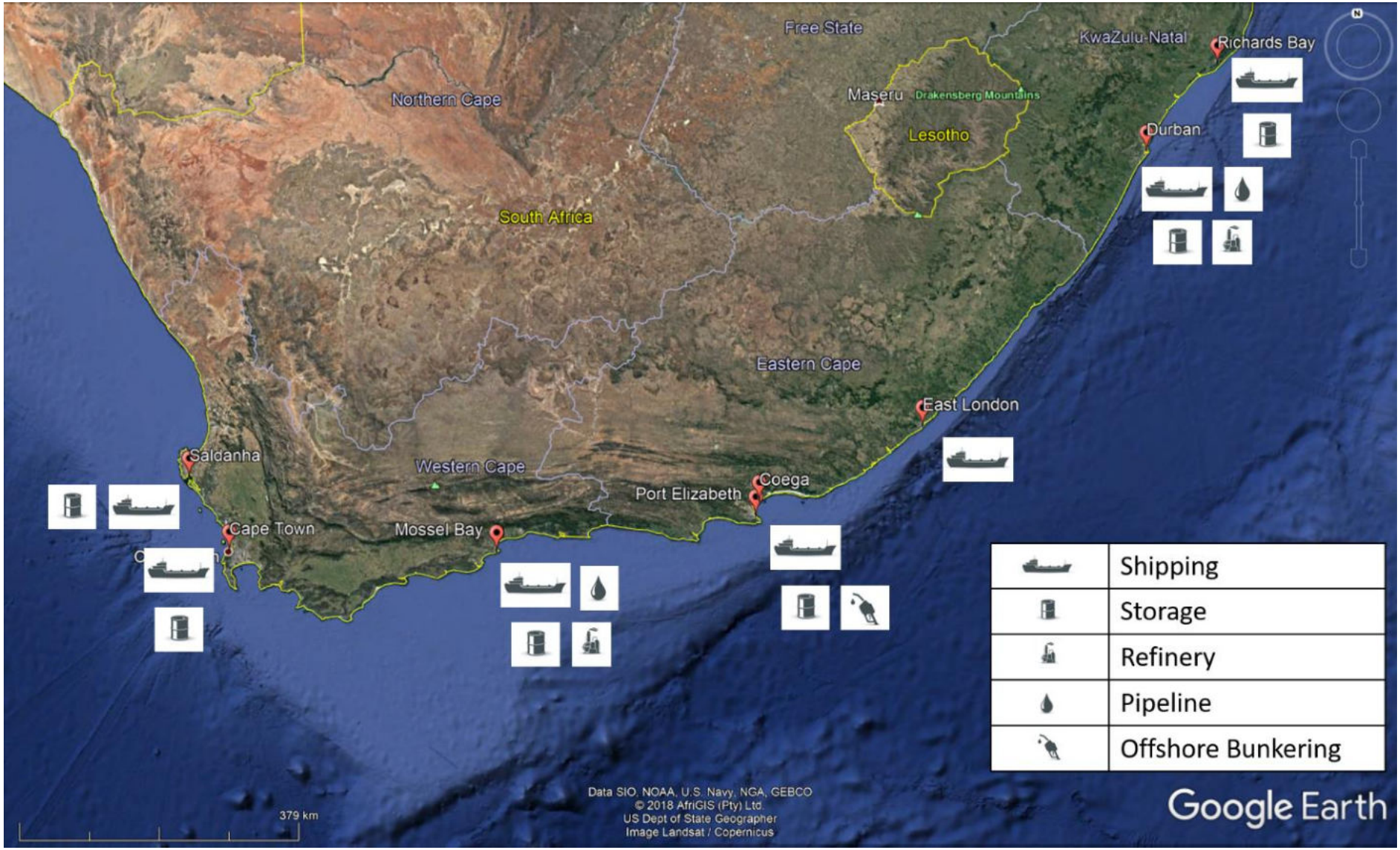



**Figure 3 South Africa map showing port activities.**

### 3.2.1 Saldanha

The Port of Saldanha is the largest and deepest natural port in the southern hemisphere, taking vessels with a draft of up to 21.5 m. There are two dry bulk berths, four break bulk berths and a liquid bulk berth capable of handling very large crude carriers (VLCC's). An oil import and iron ore export jetty extends approximately three kilometres into the bay. There is a 365 m tanker berth at the end of the ore jetty with a permitted draught of 21.25 m alongside.

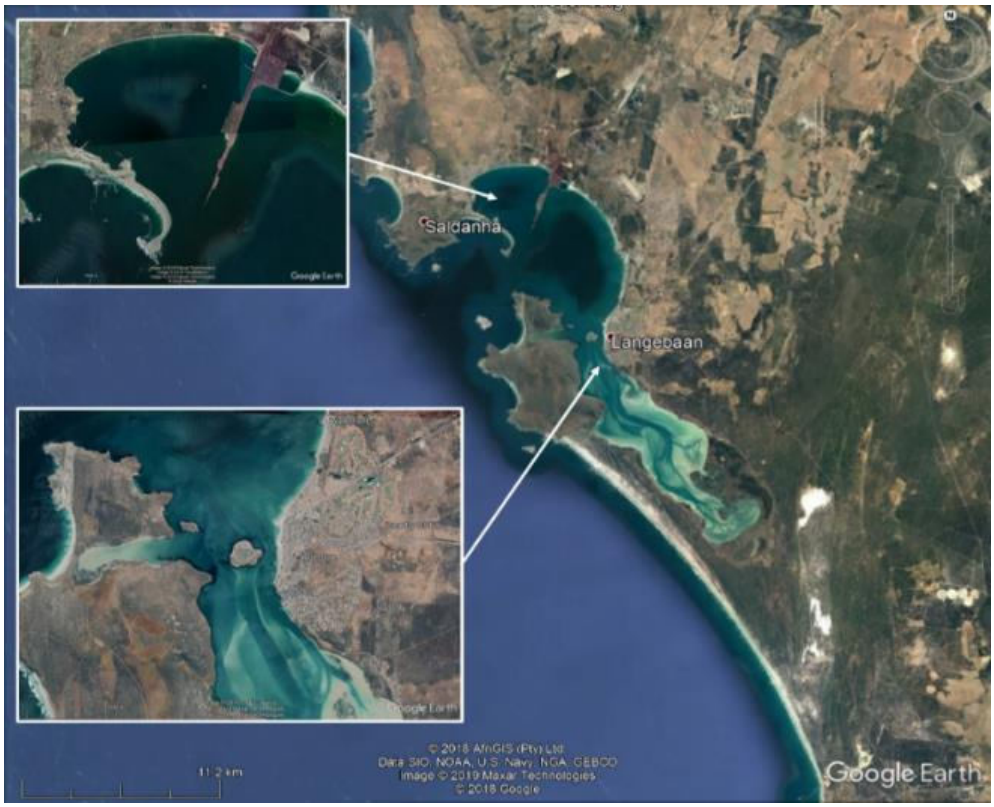



**Figure 4 Saldanha Bay**

Approximately 500 vessels a year call at the Port of Saldanha. In 2015 Saldanha Bay handled a total of 618 ships with a total gross tonnage of 40 225 933.

Port activities are expected to increase as import and export throughput increase. Presently Saldanha is not a recognised bunker port but ship to ship bunkering does occasionally take place. The process for this is that either a ship goes to anchor within the bay or alongside, and the bunkering tanker double banks to this vessel and bunker transfer hoses are rigged between the two. Saldanha port authority insists that vessels that are being bunkered are boomed off. The Port of Saldanha operates under open sea conditions. Discharge of oil is not done when swells are more than 2 - 2.5 m.

Saldanha has the potential to be exposed to crude oil and light, medium or heavy fuel oil. Two to three crude oil carrying tankers are discharged per month. The oil is pumped from the jetty to storage tanks with a capacity of approximately 45 000 m³ via a pipeline from port discharge to tank farm. Vessels chartered run on a range of fuel oils, typically an intermediate or heavy fuel oil.

Oil Pollution Control South Africa (OPCSA) provides protective booming around the offloading tankers, to reduce the risk of an uncontained spill should an incident occur. OPSCA would recover any oil contained within the boomed area. Any uncontained oil would become the responsibility of Transnet Port Authority (TNPA), and their oil spill service provider Spilltech.

### 3.2.2 Cape Town

The Port of Cape Town is situated in Table Bay and is 120 nm northwest of Cape Agulhas. The port consists of two docks, the larger outer Ben Schoeman Dock in which lies the container terminal, and the older inner Duncan Dock holding the multipurpose and fruit terminals as well as a dry dock, repair quay and tanker basin. There is also an extensive yachting marina.


**Figure 5 Port of Cape Town.**

The tanker terminal in Cape Town (terminal berths 1 and 2) import or export refined petroleum products - Mogas, Jet A1, Gasoil or diesel and HFO heavy fuel and at Eastern Mole 2 for petroleum products and fuel oil. Every tanker that calls in Cape Town to work fuel cargoes at the tanker terminal is boomed off regardless of what the product is. Vegetable and chemicals discharged at terminals 1 and 2 are not boomed off.

A bunker barge operates in Cape Town which loads and delivers MFO to vessels within the port via ship to ship method. When bunker fuel is delivered to fishing vessels in the Victoria & Alfred (V&A) Waterfront which is a tourist destination they boom off – this does not apply in the working side of the harbour.

Pilotage is compulsory for all vessels with the pilot being taken on board 1.6 miles and 155° off the main breakwater. Pilot transfer is by pilot boat. Navigation is subject to VTS and tug service is provided by four tugs operated by TNPA.

The Port of Cape Town handles on average 2,500 vessel movements per year with total imports of approximately 3.5 M tonnes and total exports of approx. 1 M tonnes. The container terminal has six deep-sea berths. The multi-purpose terminal in Duncan Dock handles fruit, steel, paper, maize, wheat, rice, timber, coal, scrap and other general cargo, as well as passenger cruise ships.

Marine Gas Oil (MGO) and Marine Fuel Oil (MFO) is received in Cape Town via pipeline from the refinery in Milnerton.

### 3.2.3 Mossel Bay

Mossel Bay is 345 km East of Cape Town at Longitude 22º 08' E and Latitude 34º 08' S. It is the smallest of the commercial South African harbours. The harbour is the only port with two offshore mooring buoys inside port limits, of which one is a marine tanker terminal single point mooring buoy used by feeder vessels from Durban and Cape Town.


**Figure 6 Port of Mossel Bay**

The Mossel Bay harbour is used mainly by fishing and service craft for the local oil industry and handles little other commercial cargo, and therefore has basic infrastructure. The fishing industry provides an important contribution to the economy of the Southern Cape and local community.

Here there are two offshore moorings for vessels to load and offload to/from:

- the Single Point Mooring (SPM) which was built in 1992 and is 3 nautical miles east of Voorbaai tank farm in a 20 m water depth; and
- the Conventional Buoy Mooring (CBM) which was built in in 1959 and is situated 1 km inshore of the SPM. The CBM is used for chemical loading and offloading which is outside the scope of this capability review.

A carrier pipeline runs from the SPM to Voorbaai tank farm. The pipeline is 3.4 km long, of which 2.0 km is subsea. This carrier pipeline contains three smaller pipelines which are used for exporting petrol and diesel and importing reformate or condensate. There are 25 tanks at the Voorbaai tank farm with the four largest tanks storing condensate.

The exported petrol and diesel are shipped to other South African ports, particularly Port Elizabeth and East London. The imported condensate and reformate are processed by at the refinery for local distribution and export.

Each SPM operation has a loading master and three divers, who stay on board the tanker until all cargo operations are completed. There are wind restrictions on when loading/unloading can take place at the SPM. The condensate and petroleum products are pumped between the tank farm at Voorbaai and the refinery.

The gas to liquid (GTL) refinery at Mossel Bay is approximately 11 km inland of Voorbaai tank farm. It started operation in 1992 and it was the world's first GTL refinery. It remains the third largest GTL refinery among

the five operating now worldwide. The refinery converts natural, methane-rich gas into low-sulphur, low-aromatic synthetic fuels and high value products.

Mossel Bay's GTL plant serves up to 15 percent of South Africa's transport fuels requirements. It produces unleaded gasoline, ultra low sulphur diesel, kerosene, low aromatic distillates, drilling fluids, liquid petroleum gas, low sulphur fuel oil, anhydrous alcohols, liquid oxygen, liquid nitrogen, carbon dioxide and waxes.

### 3.2.4 Port Elizabeth

The Port of Port Elizabeth is a multi-cargo port situated in Algoa Bay, on the south-eastern coast of Africa (Figure 7 and Figure 9). The port handles dry bulk, bulk liquid, general cargo and container cargo. Passenger ships use one of the fruit terminal berths when calling at Port Elizabeth. A total of up to 1,000 vessels a year use the port facilities.

The container terminal has three berths with a storage area of 22 hectares. The bulk terminal has six berths and a tanker berth, there are also tug, fishery and trawler jetties.


**Figure 7 Port Elizabeth and Ngqura (Coega)**

Products handled within the port include: manganese ore, petroleum products and vehicles for the motor industry. The fishing industry also makes use of the port. There are no major ship repair facilities although a slipway is available for small vessel use. In the future some of the port's present commercial activity may be lost to the new, nearby Port of Ngqura (Coega). Vessels can anchor outside the port in Algoa Bay as long as the approaches to the entrance channel are kept clear.

There are two white refined petroleum products that come ashore at the Dom Pedro Terminal. It has a 56,000t storage capacity and is usually at 50% operating volume. Usually 2 to 3 vessels per month offload product at the terminal (usually part loads), and this offloaded volume can fluctuate throughout the year. Road tankers are loaded 24/7 from Dom Pedro Terminal to transport into South Africa.

In July 2016 the first offshore bunkering service in South African waters started in Algoa Bay. Aegean Marine Petroleum Network operate their bunkering vessel from Port Elizabeth supplying IFO380 and MGO.


**Figure 8 Port Elizabeth Dom Pedro Terminal.**

### 3.2.5 Ngqura (Coega)

The port of Ngqura (Coega) is South Africa's most modern and recent port (Figure 9). It is situated at the mouth of the Coega river, 20km north-east of Port Elizabeth. The port has six berths: three for containers, two for dry bulks and one for liquid bulks. A fourth berth for containers has already been contructed to allow extra capacity in the future. Future long-term enlargement of the port will involve additional berth development up the Coega River and along Algoa Bay. It is believed to be one of the fastest growing ports in the world.

Ngqura port was developed as a deepwater container ship transhipment hub and therefore it is capable of handling the largest container ships. The port received 453 cargo vessels in 2017/2018, handling 13.830 million tonnes of cargo and is forecast in the next 30 years to handle 110 million tonnes per year.[6] The port is expected to handle exports of manganese and magnetite ore and other minerals in the near future.

It has two anchorage areas shared with the Port of Elizabeth. Offshore vessel bunkering and ship-to-ship bunkering takes place within the port. There are seven bunker barges in Ngqura (Coega).

[6] TRANSNET Ports Development Guide 2018-2019 https://www.landmarine.org/lm/transnet-ports-development-guide-2018-2019/

**Figure 9 Ngqura (Coega) Terminal.**

### 3.2.6 East London

The Port of East London is a river port situated at the mouth of the Buffalo River in the East Cape Province. On the West Bank is a car terminal capable of a throughput of 50,000 units per year due to increase to 180,000 vehicles per year. On the East Bank is a multipurpose terminal used for container ships and is capable of handling 90,000 TEU's a year. The Port of East London has a dry dock capable of handling ships of up to 200 m and a maximum beam of 24.8 m. In total there are 12 commercial berths plus a repair quay of 110 m, a pilot jetty and fishing jetty. Six of the berths lie on the West Bank. The port has a total of 2,410 m of quayside. There is an outer anchorage approx. 1 nm east of the southern breakwater, this is an exposed position.


**Figure 10 Port of East London.**

The Marine Terminal receives and distributes refined petroleum products arriving from ships coming into East London. There are also storage depots outside of the port. On average 10 to 12 vessels come into the Marine Terminal each month.

The petroleum products that are received at the terminal include petrol, diesel, illuminating paraffin, dual purpose kerosene and JET A1 fuel. All petroleum products are received from ships in the port via a pipeline to the terminal. From the Marine Terminal there are 4 discharging lines to each joint venture members respective depots, products are then dispatched via road tankers to filling stations.

Within the port there are three hose manifolds presented to the ships, two lines for refined products and one for black oils and HFO.

### 3.2.7 Durban

The Port of Durban is South Africa's busiest port handling a broad range of cargoes as well as fishing vessels and ship repair. The port has 43 operational berths some of which are currently being lengthened and deepened to allow them to accommodate container ships of up to 14,000 twenty foot equivalent unit capacity. These 43 berths handle 31% of all import and export containers from all the 8 main South African ports.

Pilotage is compulsory for all vessels from 3 nautical miles north east of the port entrance, a helicopter performs most pilot transfers, backed up by a pilot boat service if the helicopter is unable to do so. Navigation is subject to vessel tracking service (VTS) controlled by TNPA from the Millennium tower on the Bluff, this includes all ship movements within port limits.

The port is serviced by a fleet of tugs, work boats, floating cranes, dredging vessels, pilot launches, hydrographic survey vessels and a passenger harbour boat. There was a pollution vessel, the Udoti, but this was decommissioned and acquired by another company to be converted for other purposes.

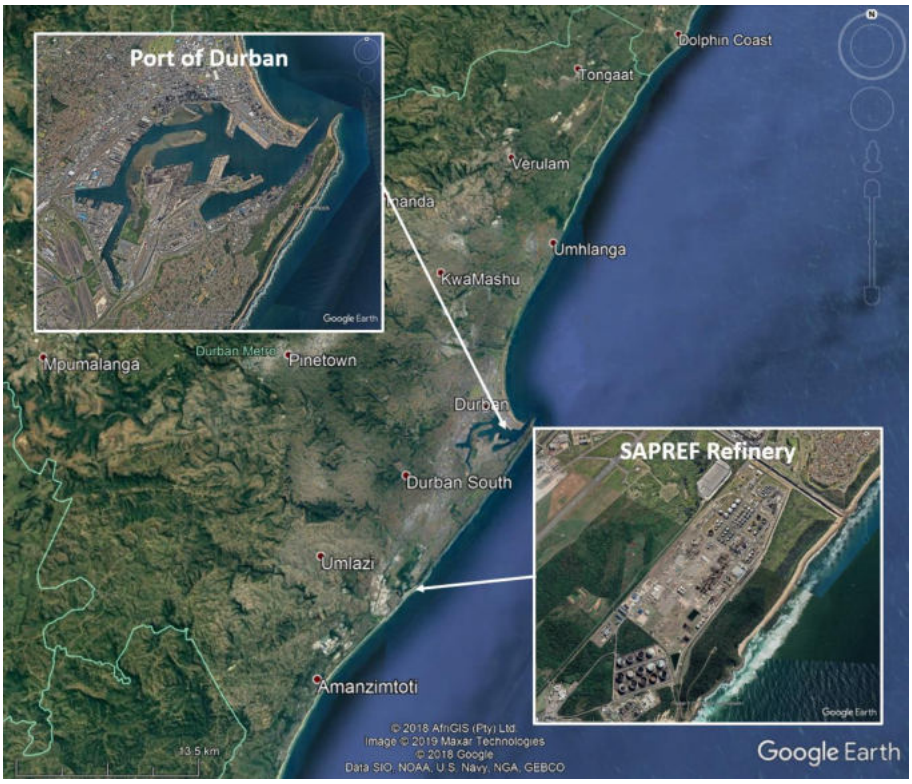



**Figure 11 Durban**

**Refinery and single buoy mooring**

There is a refinery at Isipingo, approximately 19 km south of Durban harbour. It is a joint venture operation and has an SBM located 2.5 km off Isipingo in a water depth of 50 m. The refinery is the largest crude oil refinery in Southern Africa with 35% of South Africa's refining capacity. The refinery processes 24 000 t crude/day and makes 10 main products in 46 different grades including 2.7 billion litres of petrol/year.

It is close to the coast, the closest points being approximately 350 m from the shoreline. Water from the refinery goes through a clean water separator and is tested before being released to the sea. Storm water may be released directly into the sea. The refinery carries out the different stages of separation, conversion, purification and blending. 80% of the refinery throughput is transferred to Island View by underground transfer lines.

There are storage tanks at the refinery; of which some of them (and the largest ones) hold crude oil. Most of the other tanks hold products, with some storing chemicals or other inputs for the refinery processes.

The SBM receives VLCC's (carrying approximately 2 million barrels of crude oil) and Long Range type 3 (LR3) tankers (carrying approximately 1 million barrels of crude oil). 14-15 tankers offload at the SBM every month. 80% of the crude used by South Africa comes through the SBM which has an annual throughput of approximately 25 million tonnes. Tankers occasionally double berth to offload their cargo (i.e. offload part cargo on the first berthing and then the rest on the second berthing). They are connected to the SBM by floating hoses and through a 360 degree oil tight swivel to submarine hoses which are connected to an underwater pipeline end manifold (PLEM) on the seabed. The discharged cargo is transferred by a subsea pipeline 48" in diameter and 2.5 km in length to the onshore refinery for processing.

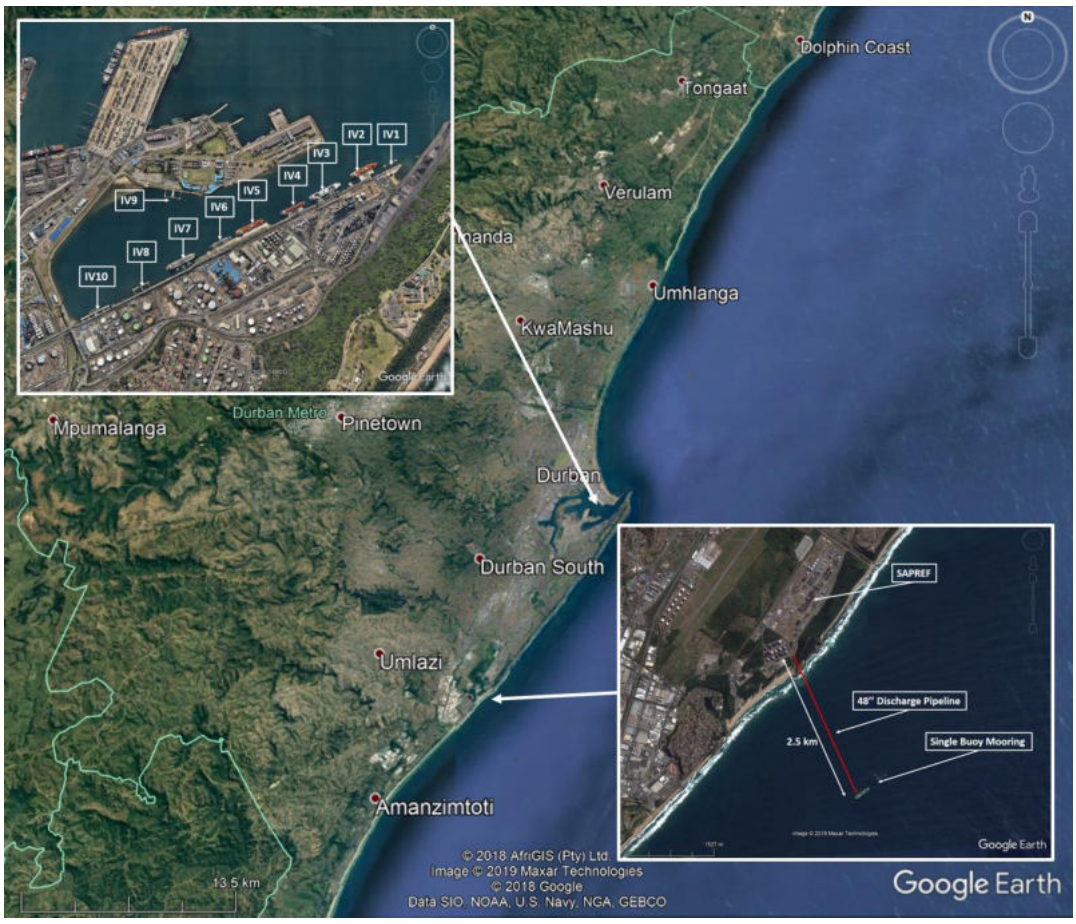



**Figure 12 SBM, Pipeline, Refinery and Island View berths.**

**Island View**

The complex has several tanks with a total capacity of around 500 000 $m^3$. Products are both exported and imported at the site. There are approximately 320-360 vessel operations a year at the site. The petroleum products handled are aviation fuel (avgas/Jet A1), all grades of petrol, diesel, gasoil, marine fuel oil and paraffins and all are stored at tanks at IV. Four bunker barges (fuel oil and MGO) operate within the Port of Durban loading from IV 10.

A stockpile of oil spill response equipment is held in Island View and is made up predominately of tier 1 spill response materials.

### 3.2.8 Richards Bay

Richards Bay is South Africa's most northernmost and easterly port, it is 160 km northeast of Durban and 465 km southwest of Maputo. The Port of Richards Bay was built in 1976. Richards Bay is situated in a large natural lagoon and is dredged to 19 m making it one of South Africa's deep-water ports. There are two main terminals, the Multi Purpose Terminal (MPT) and the Dry Bulk Terminal (DBT). The MPT can handle a variety of cargo types including; break bulk, neo-bulk and containers. The DBT handles more than 13 million tons of cargo each year and can transfer multiple products over its conveyer system. The port handles 330 vessel movements a month. Richards Bay has a total of 21 operational berths ranging in length up to 350 m.


**Figure 13 Port of Richards Bay.**

Pilotage is compulsory for all vessels from 3 nautical miles southeast of the south breakwater, a helicopter performs most pilot transfers, backed up by a pilot boat service if the helicopter is unable to do so. Navigation is subject to VTS operated by TNPA from port control offices, which oversees all shipping movements inside port limits.

Richards Bay is popular for cruise ships because of the close proximity to game parks and the St Lucia World Heritage Site. Cruise ships make use of either the small craft berth or one of the normal cargo handling berths depending on the size of the ship. There is a modern marina for recreational sailing next to the tug and dredging berths in the small vessel basin. Other water sports and recreational activities are permitted within

the harbour at dedicated locations. There are areas of mangroves within the harbour, including directly behind the berths at the northern end of the dry berth terminal.

**Joint Bunkering Services (JBS)**

JBS carries out bunkering of Marine Fuel Oil (MFO) and Marine Gas Oil (MGO) to vessels and have associated storage tanks.

The fuel is transferred from the tanks to berth 209 via an approximate 1 km pipeline. Two bunker barges operate at Richards Bay. They hold 3 800 – 5 700 $m^3$ MFO and 800 $m^3$ of MGO. Refuelled vessels will take between 300 and 1,800 $m^3$ fuel oil. There are automatic shutdown valves at the control room and a manual shut down valve at the berth. A gauge continuously monitors flow.

They hold a stock of equipment in Richards Bay which includes some air inflation containment boom and recovery devices.

## 3.3. Oil Characteristics

The types of oils handled in the South African ports within this review are shown in Table 5.

**Table 5 Oil inventory of oil types handled in South Africa**

| Oil Type | Characteristics |
|---|---|
| Crude | Various crudes:<br>Specific Gravity (SG): 0.79 – 0.97<br>Viscosity: <0.9 cSt - >20000 cSt @ 40°C (104°F)<br>Could contain hydrogen sulphide ($H_2S$) |
| Fuel oils | Marine fuel oils (MFO). Characteristics vary depending on the type of oil (more information below). |
| Intermediate Fuel Oil (IFO) | Characteristics vary depending on the type of oil (more information below).<br>Its density at 20°C is 0.9850 g/cm$^3$ and kinematic viscosity of 180 mm$^2$/s at 50°C. |
| Heavy Fuel Oil (HFO) | Characteristics vary depending on the type of oil (more information below).<br>Typically, density > 0.9 g/cm$^3$ and viscosity > 180 cSt at 50°C. |
| Low Sulphur Fuel Oil | Exact characteristics unknown<br>Viscosity: average around 100 cSt (range 5 cSt to above 380 cSt at 50°C) for some fuels. |
| Marine Gas Oil | Characteristics vary depending on the type of oil<br>Specific Gravity: 0.82-87<br>Viscosity: 1.4 to 5.5 mm$^2$/s at 50°C<br>(typical values as exact oil characteristics unknown) |
| Condensate | API°>40<br>Specific gravity: 0.5 to 0.8 |
| Hydraulic oil | API <35<br>Viscosity 100 cSt @ 30°C |
| Lube oil | API 29<br>Viscosity 79-86 cSt @ 20°C |
| Petrol | Specific density 0.72 to 0.76 g/m$^3$<br>Kinematic viscosity <1 at 30°C<br>Flash point -30°C |
| Diesel | Specific Gravity: 0.802 - 0.844<br>Viscosity: 2.2 cSt – 5.3 cSt @ 40°C (104°F)<br>Boiling point of 369.8 °C. |
| Kerosene | Density of 0.76 to 0.81 g/cm$^3$<br>Viscosity: 1 to 1.9 sCt at 40°C<br>Boiling point: 200 to 260 °C |
| Reformate | Specific gravity: 0.79 at 68F<br>Flash point: -120°C<br>Relative density: 0.5-0.7 |
| Jet A1 | Specific gravity: 0.8<br>Flash point: 38 °C |

**Aviation fuel**

Jet A1 (Specific Gravity 0.8 g/cm3, °API 45) is a kerosene type aviation gas-turbine engine fuel and is categorised as Group 1 under the ITOPF oil classification. Jet A1 flows easily and spreads rapidly. They are easily dispersed and do not have any tendency to emulsify. As this oil is composed of mainly the low-weight components, they are highly volatile. They will evaporate and dissolve readily and leave little or no residue. However, many of these low-weight components are toxic and potentially flammable and readily inhaled and are of concern for human health and safety.

**Kerosene**

Kerosene also known as paraffin is a combustible hydrocarbon widely used to power jet engines and as cooking and lighting fuel. It has a density of 0.76 to 0.81 g/cm$^3$, a viscosity of 1 to 1.9 sCt at 40$^o$C and a boiling point of 200 to 260$^o$C. When spilled, kerosene spread rapidly into thin sheens and as diesel it will rapidly evaporate and naturally disperse.

**Reformate**

Premium blending stock for high-octane gasoline formed by catalytic reforming, which is a chemical process used to convert petroleum refinery naphthas, they are distilled from crude oil into high-octane liquid products. It has a specific gravity of 0.79 at 20 $^o$C and a flash point of -120$^o$C.

**Petrol**

Petrol or gasoline is a complex mixture of many volatile, flammable and liquid hydrocarbons derived from petroleum and used as fuel for internal combustion engines. Gasoline is a mixture of paraffins, oleofins and cycloalkanes; this blend is adjusted to altitude and season. It has a specific density between 0.72 to 0.76 g/m$^3$, kinematic viscosity <1 at 30$^o$C and a flash point of -30$^o$C.

In a warm climate, gasoline will evaporate on water within one day and approximately two days in a cold climate. It will disperse naturally to a large degree in turbulent waters.

**Diesel**

Diesel fuel is a light petroleum distillate. Diesels vary in their properties but have a specific gravity in the range 0.84-0.88 g/cm$^3$ (30-37$^o$API), with pour points of between -17$^o$C and -30$^o$C. As such they are generally classed as Group II oils, i.e. light persistent oils, under the ITOPF classification of oil according to their specific gravity. Diesel will evaporate to the extent of 60% in approximately 3 days on warm water and 6 days in very cold water.

**Marine Gas Oil**

Marine Gas Oil (MGO) describes marine fuels that consist exclusively of distillates. Distillates are all those components of crude oil that evaporate in fractional distillation and are then condensed from the gas phase into liquid fractions. MGO usually consists of a blend of various distillates. It has a boiling point > 170 °C, flash point of > 60 °C, boiling point of <-7 °C, upper explosion limit of 7% and lower explosion limit of 0.6%. Its density at 20 °C is 0.8900 kg/m$^3$ and kinematic viscosity at 40 °C is 11 mm$^2$/s. MGO typically evaporates and disperses into the water column readily.

**Intermediate Fuel Oil**

Intermediate Fuel Oil (IFO) can be a mix with 180 cSt or 380 cSt. IFO 180 is a mix of 98% of residual oil and 2% of distillate oil. And IFO 380 is a mix of 88% of residual oil and 12% of distillate oil. Due to the higher content in distillate oil, IFO 380 is often more expensive than IFO 180.

IFO is a blended oil with a high proportion of heavy fuel oil blended with MGO. It is dark brown, has a flash point > 61$^o$C and boiling point > 204 °C. Its density at 20$^o$C is 0.9850 g/cm$^3$ and kinematic viscosity of 180

mm$^2$/s at 50$^o$C. It tends to persist in the marine environment. Dispersant have been found to be effective on fresh intermediate fuel oil.

**Heavy Fuel Oil**

Heavy Fuel Oil (HFO) is a mixture of the heavy residual oil, left after the lighter components of crude oil are removed during the refining process, with lighter oils blended to meet specifications for viscosity, pour point and specific gravity. HFOs can also be a blend of heavy and light oils but they generally contain more of the heavier components. In the MARPOL Marine Convention of 1973, heavy fuel oil is defined either by a density of greater than 0.9 g/cm³ at 15°C or a kinematic viscosity of more than 180 cSt at 50°C. Heavy fuel oils have large percentages of heavy molecules such as long-chain hydrocarbons and aromatics with long-branched side chains.

**Low Sulphur Fuel Oils**

Since January 1, 2015, in accordance with Annex VI of the MARPOL Conventions, ship emissions must contain no more than 0.1% sulphur in such Emission Control Areas (ECAs) protected areas and ships globally will now have to use low sulphur marine fuel oils with a sulphur ≤0.50 % compared to the former sulphur limit of 3.50%.

The characteristics of max. 0.50%-sulphur fuels will be governed by the petroleum crude source from which they are derived, coupled with the availability of refinery processing and blending components. Fuel characteristics are expected to vary considerably, especially for the residual fuel grades, as it is anticipated that a range of residue streams and cutter stocks from refinery process units may be used as blending components. Fuel characteristics—especially density and viscosity—are also likely to vary with location and supplier. However, it is fully expected that fuel oils as supplied, meeting the 0.50% sulphur limit, will range from light distillates through to heavy residual fuel oil with a range of widely differing fuel oil formulations in between.[7] Theses oils have varying pour points (typically high), asphaltene and wax contents.

**Hydraulic oil**

Hydraulic oil (specific gravity 0.88 g/cm3, °API < 35, viscosity 100 cSt @ 30°C, pour point < 0°C, flash point >60$^o$C) is a relatively viscous oil and is classed as Group III oil under the ITOPF classification of oil according to their specific density.

Hydraulic oil has a low volatility and moderate flash point, so there is no major safety issue when dealing with this oil. However, this oil is fairly persistent in the environment. Expect limited spread and minimal loss through evaporation and natural dispersion. The action of mixing energy on hydraulic oil is likely to produce a frothy emulsion.

**Lubricating oil**

Lubricating oil or 'lube oil" (specific gravity 0.87 g/cm3, °API 29, viscosity = 79-86 cSt @ 20$^o$C, pour point -35$^o$C, flash point >60$^o$C) is relatively viscous oil and is classed as Group III oil under the ITOPF classification of oil according to their specific density.

Lube oil flows easily and is easily dispersed if treated promptly. However, this oil tends to persist in the environment. There is a likelihood that the action of mixing energy on lube oil will produce frothy emulsions. With the low volatility and moderate flash point, there is no major safety issue when dealing with this oil.

[7] Joint Industry Guidance- The supply and use of 0.50%-sulphur marine fuel, 2019

# 4. Environmental Information

## 4.1. Winds and Current

### 4.1.1 Current

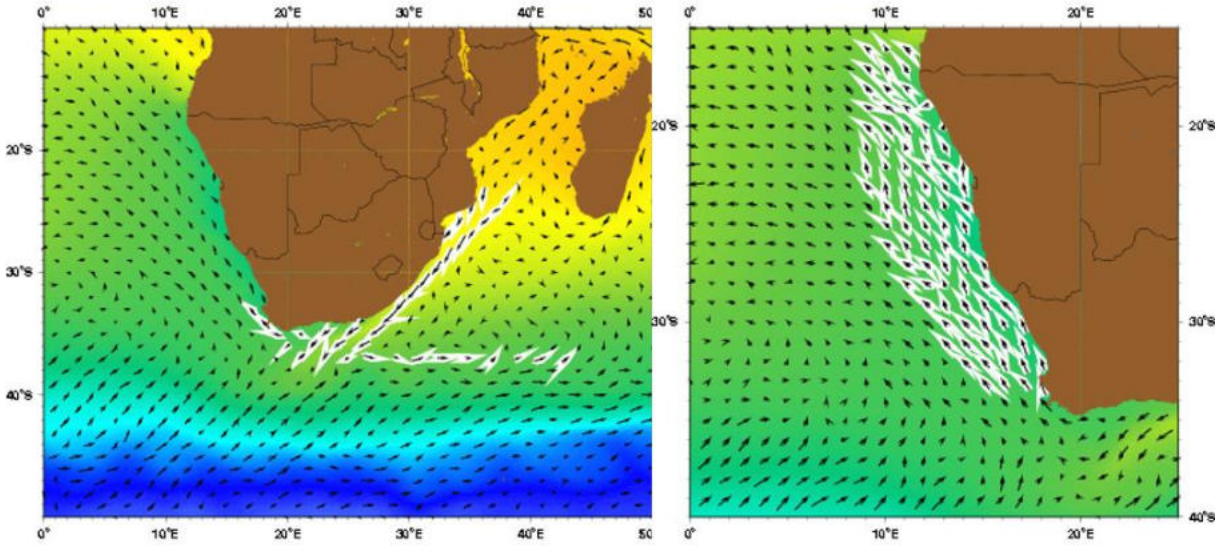



**Figure 14 The Agulhas Current and the Benguela Current yearly average direction.**
***Source: www.oceancurrents.rsmas.miami.edu***

The Agulhas Current flows strongly down the east coast of Africa from 27°S to 40°S. Like other western boundary currents, the Agulhas Current is quite fast. At the surface, it can reach maximum speeds of 3.8Kts. As one of the major currents in the Southern Hemisphere, the Agulhas Current system transports large volumes of water. As the Agulhas Current reaches the southern tip of the continental shelf of Africa, it begins to turn toward the west. Sea surface temperatures in the region show a decline of about 2°C moving from north the south, with maximum average temperatures ranging from 28°C (summer) and 23°C (winter) in the north and from 25°C (summer) and 21°C (winter) in the south.

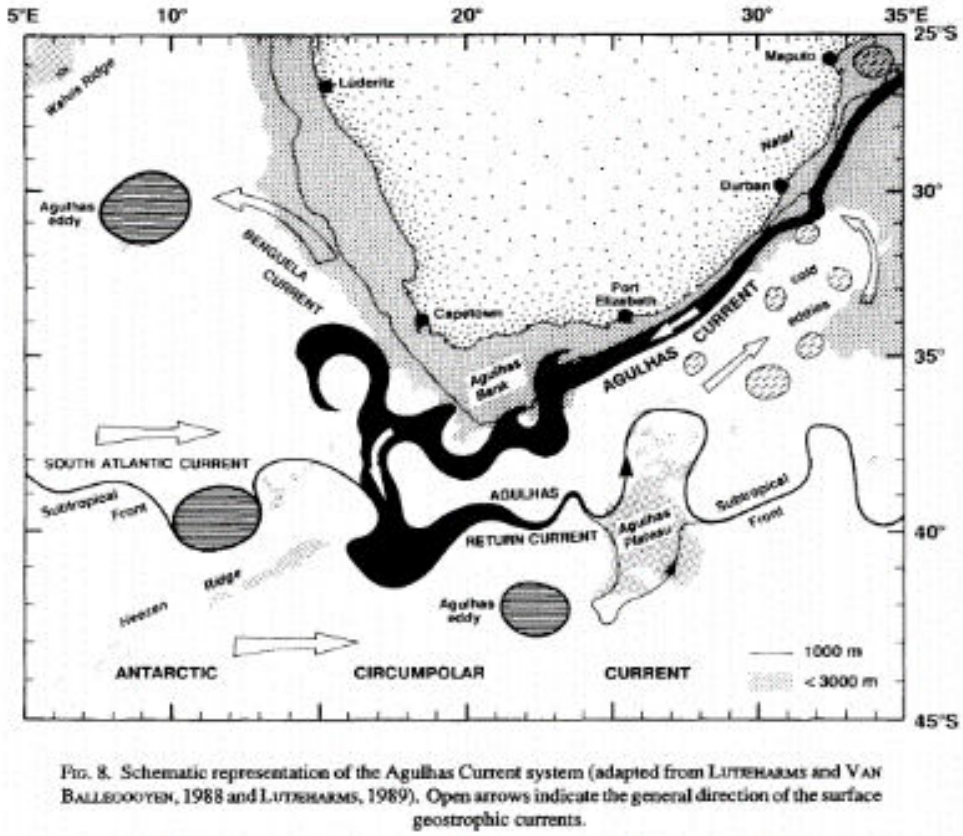



FIG. 8. Schematic representation of the Agulhas Current system (adapted from LUTJEHARMS and VAN BALLEGOOYEN, 1988 and LUTJEHARMS, 1989). Open arrows indicate the general direction of the surface geostrophic currents.

**Figure 15. The Agulhas and Benguela Currents.**

*Source: Lutjeharms, J.R.E., and R.C. van Ballegooyen, (1988).*

*The Retroflection of the Agulhas Current, Journal of Physical Oceanography, 18, 1570-1583.*

The Benguela Current is the eastern boundary current of the South Atlantic subtropical gyre. It begins as a northward flow off the Cape of Good Hope, where it skirts the western African coast equatorward until around 24°S-30°S. The Benguela Current has a well-defined mean flow that is mostly confined near the continent and a more variable transient flow on its western side. The transient flow is dominated by large eddies shed from the Agulhas Retroflection. The temperature regime in the Benguela Current region is strongly seasonal, with average surface temperatures ranging between 21°C and 15°C in summer and between 17°C and 13°C in winter. Compared to the west coast, primary production is much lower owing to the warm, nutrient-poor tropical waters introduced from the equatorial region of the western Indian Ocean.

## 4.2. Sensitivities

The south African coastline stretches from the Orange River on the west coast to Ponta do Ouro on the east coast, a distance of approximately 3100 km. There are nearly 300 river catchments draining into the coastal zone through functional estuaries. These estuaries constitute much of the sheltered marine habitat along South Africa's coastline and consequently they are important for biodiversity as well as socio-economic development.

The distribution of habitat types can be partly explained by geography, likely reflecting large-scale patterns in coastal geology. The west coast is characterised by very varied substrates with clear contrasts between rocky cliffs, long sandy beaches, extremely sheltered deep bays and highly exposed open coasts. The majority of South Africa's long dissipative beaches are found in along this stretch of coast. The south coast comprises largely a series of log spiral bays (e.g. Mossel Bay, Plettenberg Bay and Algoa Bay) interspersed with cliffs or long stretches of rocky coastline (e.g. the Tsitsikamma coast). Cliffs, rocky shores and intermediate estuarine

pocket beaches dominate the transition zone into the east coast. Along the east coast rocky shores and sandy beaches dominate the south whereas beaches become more intermediate and dissipative-intermediate in the north.

The coast spans three biogeographical regions (or coastal climatic zones), namely the cool temperate west coast, warm temperate south coast and subtropical east coast. South Africa has a complex interaction between the ocean and the atmosphere, combined with high variability in rainfall patterns and variety of biodiversity ones, it is not surprising that South Africa displays such high levels of marine biodiversity within such a small area. Some 10,000 species of plants and animals have been recorded, representing 15% of the global marine species diversity.

In a National Biodiversity Assessment, 2011, the ecosystem threat status of 136 marine and coastal habitat types were assessed. From this assessment, a total of 64 habitat types (47% of total amount of habitat types) were considered threatened. Seventeen percentage (17%) of these habitat types were critically endangered, 7% endangered, 23% vulnerable and 52% least threatened. Although 47% of habitat types are considered threatened (i.e. critically endangered, endangered and/or vulnerable), the overall area of threatened habitat is less than 30% of the marine and coastal environment considered.

There are several designated Marine Protected Areas across South Africa to protect offshore ecosystems covering a range of diverse habitats such as such as reefs, mangroves and coastal wetlands. Offshore, these areas will protect vulnerable habitats and secure spawning grounds for various marine species, therefore helping to sustain fisheries and ensure long-term benefits important to food and job security. Figure 16 shows the Marine Protected Areas across South Africa. Further details of the sensitivities around each Port area are summarised in Table 6 below.

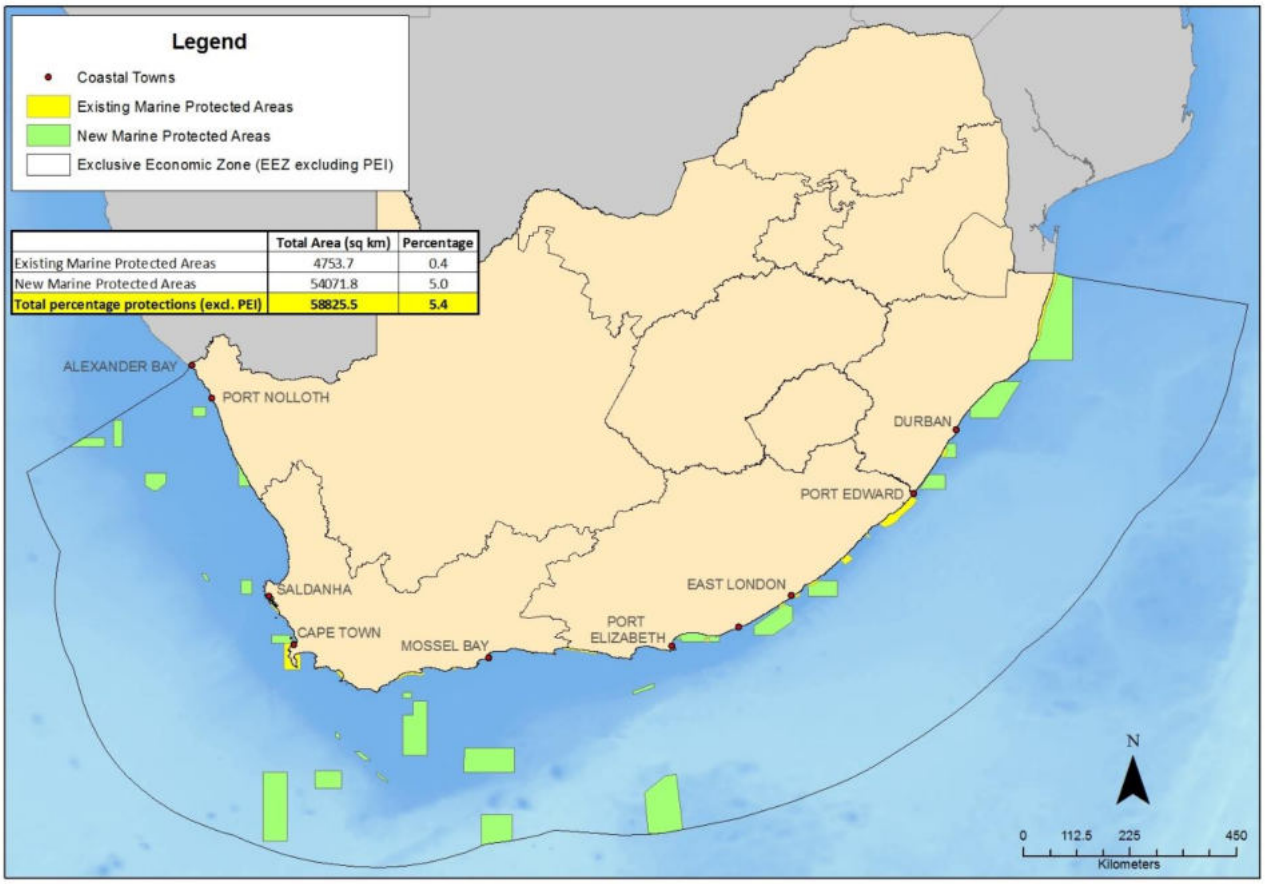



**Figure 16 Marine Protected Areas in South Africa.**

**Table 6 Summary of sensitivities around each South African coastal city in this study**

| | | Saldanha | Cape Town | Mossel Bay | Algoa Bay (Port Elizabeth/Coega) | East London | Durban | Richards Bay |
|---|---|---|---|---|---|---|---|---|
| Environmental | **Breeding / spawning / calving areas** | Important breeding sites for endangered and threatened species such as penguins, gannets, cormorants and other seabirds; | Robben Island and Boulders Penguin Colonies, which are breeding sites for endangered and threatened species such as penguins, gannets, cormorants and other sea birds.<br>Spawning areas for species such as anchovy and sole;<br>False Bay, which is a spawning ground for various fish and squid. Squid are highly sensitive;<br>False Bay is a calving area for the southern right whales, and otters are common along certain parts of the coast. | Supports a high diversity of endemic teleost species (ray-finned fishes) are supported by inshore protected bays, such as Mossel Bay. Spawning of the majority of species endemic to the area occurs in spring and summer.<br>Fifteen species breed within the South Coast region, including cape gannets, African penguins, cape cormorants, white breasted cormorant, roseate tern, damara tern, swift term and kelp gulls. | Offshore Islands, such as St Croix and Bird Island, which are breeding sites for endangered and threatened species such as penguins, gannets, cormorants, Damara Terns and other sea birds<br>Spawning areas for species such as anchovy and sole<br>Algoa Bay is a calving area for the southern right whales, and otters are common along the coast. | Spawning areas for species such as anchovy and sole. | Estuaries and lagoon habitats used as spawning grounds for bait organisms, fish and water birds. | Spawning and juvenile recruitment areas for species such as maasbanker and round herring, hake, pilchard and anchovy. |
| | **Habitats** | Multiple estuaries and lagoons which are important for bait organisms, fish, water birds and recreational amenities; | A number of estuaries and lagoons which are important for fish, water birds and recreational amenities; | Unconsolidated seabed sediments, rocky reefs and the water column.<br>The inshore areas are an important nursery | A number of estuaries and lagoons and associated navigable rivers which are important for bait organisms, fish, water | Important habitats for birdlife in particular, migrant waders at the mouth of the Keiskamma River. | Significant importance for birdlife, especially: migrant waders, terns, gulls and pink-backed pelicans. | Richards Bay Sanctuary which supports an extensive mangrove community and rich birdlife; |

| | | Saldanha | Cape Town | Mossel Bay | Algoa Bay (Port Elizabeth/Coega) | East London | Durban | Richards Bay |
|---|---|---|---|---|---|---|---|---|
| | | Langebaan Lagoon is a large salt water lagoon, regarded as a protected wetland (stopover for migrant waders). It is divided into three zones: Controlled, Restricted and Sanctuary. and power boating are only allowed in northern most zone, north of a line joining Beacons, in Kraal Bay and at the Oesterwal.<br>Numerous Islands supporting seabirds and seal colonies. | Habitats within the Table Mountain National Park Marine Protected Area (MPA) for white sharks, abalone, African penguins and several over-exploited line fish species, such as poenskop and red steenbras. | ground for many line fish species. The fish most numerous on the shelf, beyond the shelf break and in the offshore waters, are the large migratory pelagic species, including various tunas, billfish and sharks, many of which are considered threatened by the IUCN, primarily due to overfishing. | birds and recreational amenities<br>Marine reserves and sanctuaries such as salt marshes. | A number of estuaries and lagoons with mangrove and salt marsh habitats which are important for bait organisms, fish, water birds and recreational amenities.<br>Coastal Forest Reserves | Offshore sea bird species using the area for foraging and feeding.<br>Mangroves across this area.<br>Coastal Forest Reserves.<br>Aliwal Shoal marine protected area; rich in biodiversity including many fish species and the location of where ragged-tooth sharks gather. | Estuaries and lagoons which are important for bait organisms, fish, water birds and recreational amenities as well as mangrove stands. |
| **Socio-economic** | **Tourism and recreation** | Power boating<br>Popular beaches, surfing and sailing areas; | Recreational amenities such as popular beaches, tidal pools, surfing and sailing areas.<br>Port of Cape Town / V&A Waterfront popular tourist destination. | Mossel Bay has 4 out of the 23 Blue Flag beaches in the Western Cape. | Recreational amenities such as popular beaches, tidal pools, surfing and sailing areas. | Recreational amenities such as popular beaches, tidal pools, surfing, angling and sailing areas. | The recreational areas including Durban's amenity beaches, tidal pools, surfing, angling and sailing areas. | Popular beaches, tidal pools, surfing and sailing areas. |
| | **Fisheries / Aquaculture** | Recreational fishing in northern part of Langebaan Lagoon. | Commercial considerations such as shellfish and seaweed collection, rock lobster catches, | Mossel Bay zone-oyster collection: highest annual yield is from this area. | Commercial considerations such as oyster and seaweed collection, rock lobster catches, | Commercial considerations such as shellfish and seaweed collection, demersal and line fish landings. | Commercial fisheries for shellfish, crustaceans and line caught fish. | Commercial considerations such as shellfish and seaweed collection, rock lobster catches, |

| | | Saldanha | Cape Town | Mossel Bay | Algoa Bay (Port Elizabeth/Coega) | East London | Durban | Richards Bay |
|---|---|---|---|---|---|---|---|---|
| | | West Coast trawling grounds: pelagic and demersal fish.<br>Commercial considerations such as shellfish and seaweed collection, rock lobster catches, demersal and line fish landings. | demersal and line fish landings.<br>Recreational and subsistence fishing- TMNP Marine Protected Area (MPA) | | demersal and line fish landings. | | | demersal and line fish landings. |
| | **Water intakes** | Seawater intakes for diamond diggings and fish processing plants. | Koeberg Power Station intake basin for cooling water. | Desalination plant inlets- Mossel bay, Sedgefield, Knysna and Plettenberg Bay. | Intake for salt works | Seawater intakes for fish farms, aquarium and City sanitation system. | Commercial sea water intakes. | Alusaf and Mhltuze Water seawater intakes in Richards Bay harbour. |
| | **Industry** | Offshore diamond recovery operations.<br>Saldanha port operations. handling bulk ore and crude oil. | Port of Cape Town operations- vessels for various industries operate in the port. | Mossel Bay commercial harbour used for offshore industry and fishing fleet. | Port of Elizabeth and Port of Ngqura various industries and associated vessels | Port of East London various industries and associated vessels | Main harbour area with tanker terminal, container quay and extensive commercial operations. | Port of Richards Bay various industries and associated vessels. |

# 5. Resources

Resources available within South Africa are detailed below. Not all the resources listed are guaranteed but are expected to be released for a severe oil spill that was declared a national emergency.

## 5.1. Resources summary

**Table 7 Resource availability summary table**

| Response Technique | Response ready in country capability? | |
|---|---|---|
| Surveillance, modelling and visualisation | X | No on call designated resource. Helicopters are available from TNPA, oil industry operators or private charterers at several locations. |
| Offshore surface dispersants | X | Vessels are available that could be used as vessels of opportunity for dispersant spraying.<br>No dispersant stocks. |
| At sea containment and recovery | X | The only vessel towable boom is held by OPSCA in Saldanha. Offshore skimmers are available in several locations. |
| Protection of sensitive resources | √ | Nearshore boom suitable for sensitive resource protection are available from several operators and agencies. |
| Shoreline clean-up | √ | Several stockpiles of hand tools and near shore equipment exists. |
| Oiled wildlife response | √ | Oiled wildlife organisations exist with facilities and in country expertise. |
| Waste management | √ | Hazardous landfill sites and land based temporary storage exists. |

## 5.2. Organisations with oil spill response resources

### 5.2.1 DEFF

The DEFF OSR equipment stockpile was inspected during the site visit and is located in Paarden Eiland, Cape Town and could be mobilised nationally.

DEFF prioritised providing shoreline rather than offshore resources as offshore containment and recovery equipment is expensive and will not be suitable in every spill due to the nature of the oil spilt and weather conditions in coastal South Africa. The DEFF stockpile is made up of a large amount of nearshore containment and recovery equipment including: inflation chamber boom, weir skimmers, vacuum systems, rope mops, disk skimmers and some associate ancillaries (including some hoses and pumps). There is also a large amount of sorbent boom sections. Temporary storage of waste oil is achieved with two Fastank 2000s.

At the time of the visit DEFF were moving the oil spill equipment to the alternative storage location close to the port. Most equipment was stored in the old location. Ancillaries were not stored with main equipment and no equipment labels or standard operating procedures were with the equipment. A small amount of new equipment was seen at a new storage location closer to the port. There was equipment in the new location that had not been commissioned. Hydraulic hoses within the stockpile required testing and/or replacement. We understand that some of the equipment was due to be disposed of but this equipment was not clearly marked.

DEFF used to have a stockpile of dispersant. It was disposed of as testing showed it had degraded therefore was no longer effective.

**Surveillance**

DEFF own and operate unmanned aerial vehicles (UAV) which could be used to provide a live stream for oil spill surveillance. They are in Cape Town and could be mobilised within 24-48 hours depending on the spill location and if the UAVs had to be flown to another location. Flight clearance would have to be obtained before a UAV could be flown for surveillance but permission is expected to be granted rapidly (~3 hours).

DEFF are developing modelling and have an oil spill model that was used and tested during a spill at Algoa Bay. It is being refined for areas outside Algoa Bay (under development). DEFF can assist with current datasets for oil spill modelling.

**Patrol boats**

DEFF have four patrol boats which have a dual role - they patrol the fishing grounds around South African waters and are to be used for pollution control. They are fitted with spray arms and dispersant tanks. At the time of visiting, it was unclear if these tanks had dispersant in them. If they do contain dispersant, it will be from the same stock that has been disposed of due to it degrading and therefore will be ineffective at dispersing oil on water. The four vessels comprise of:

- 1 x offshore patrol boat - this is the largest patrol boat, classed an ocean patrol boat; and
- 3 x inshore patrol boats - these are small, fast patrol boats.

### 5.2.2 Navy

The navy have an oil spill warehouse at Simons Town near Cape Town. Much of the equipment is still in its original packaging so is clean and visually in good order but cannot be used for exercises. Boom/plastic that remains folded in one position will degrade along a fold or crease over time. The condition of the equipment needs to be confirmed and it can't be assumed that all the following equipment is response ready. The stockpile is listed by the Navy to consist of near shore air inflation chamber boom, solid floatation fence boom, rope and weir skimmers, bubble screen system, a decontamination unit, temporary storage tanks and granular and pad sorbents.

### 5.2.3 SAMSA / AMSOL

Neither SAMSA nor AMSOL hold oil spill cleanup equipment.

SAMSA, on behalf of the Department of Transport, have an emergency towing and salvage vessel contract which is held by AMSOL. Under this contract, AMSOL provide a salvage and towing tug the SA Amandla.

AMSOL hold a variety of vessels, with appropriate trained masters and crew, for work around the South African coastline. None are designated for oil spill response activities but would be suitable as vessels of opportunity if available during an oil spill.

### 5.2.4 Oil Pollution Control South Africa (OPSCA)

OPSCA have a warehouse in Saldanha. They are government owned and are contracted to provide preventative booming for offloading crude tankers but if instructed to by management would respond to an oil spill. They hold response ready offshore boom - capable of being towed to collect free floating oil. They have a range of oil skimmers including brush skimmers, disk skimmers, weir skimmers and a mechanical skimmer. They also have a shallow water landing craft and a boom towing vessel.

### 5.2.5 Private tier 1 service providers

There are a variety of Tier 1 service providers who were visited as part of this review. Some (most commonly Spilltech) hold contracts with SAPIA stakeholders to provide onsite or on call equipment and personnel. All Tier 1 providers would make their resources available in spill (where there are conflicting priorities this would be on a best effort basis).

**Spilltech**

Spilltech have a hi-tech 24/7 command centre in Durban, equipment warehouses in Durban and in Cape Town and smaller equipment stockpiles positioned near ports.

Equipment owned includes air inflation booms, fence boom, weir, disk and rope mop skimmers, small boats for boom deployment, vehicles for personnel, equipment and transport, large quantities of sorbents

(granular, pads and booms), hand tools for shoreline clean up, numerous skips and PPE. The equipment is suitable for harbour, nearshore or shoreline response.

Spilltech have responders at each of the equipment locations. Personnel would be supplied initially from the next nearest centre and further afield from Spilltech's national network if required. These staff have not received any IMO accredited spill response training but have experience in deploying Spilltech equipment.

**Drizit**

Drizit are both an oil spill response provider and a manufacturer of oil spill response equipment. They have a factory in Durban and a small warehouse of equipment in Cape Town. They have air inflation boom, fence boom, weir, disk and rope mop skimmers, sorbents (granular, pads and booms). They have and/or can access vehicles and small boats for boom deployment. The equipment available is suitable for harbour, nearshore or shoreline response.

**Extreme projects**

Extreme Projects have a service contract for bunkering operations in Port Elizabeth for TNPA. They have two vessels in Port Elizabeth and Cape Town. They hold equipment in Port Elizabeth which mainly contains fence boom and sorbents,a response trailer and two 20ft containers in Ngqura (Coega). They also have a drone than can be used for aerial surveillance.

### 5.2.6 Wildlife response providers

SANCCOB have facilities in Cape Town and Port Elizabeth. In Cape Town SANCCOB have a recently upgraded, purpose-built facility. It has a hospital building with two intensive care units, a surgery, laboratory, medication room and x-ray room. There is a three-part wash bay area for oiled birds and a walk-in freezer to store fish to feed birds in care. In Port Elizabeth SANCCOB have an oiled wildlife rehabilitation centre with adjoining visitor centre. The centre has the capacity to rehabilitate over one hundred birds at a time and assess their health prior to release back into the wild.

There is one pool area for resident birds and three further pools to allow birds different levels of access to water to build up swimming strength as part of their pre-release rehabilitation.

SANCCOB have 40 staff including support functions. Approximately half the staff are trained in rehabilitation. These staff are trained to a level whereby they could train volunteers or other non-skilled staff to carry out wildlife response roles in a large spill. SANCCOB have staff vets. They train approximately 150 volunteers a year in wildlife response.

Other wildlife organisations are listed in the draft National Oiled Marine Wildlife Preparedness and Response Contingency Plan. These include uShaka who were visited as part of this capability review. uShaka rehabilitate stranded marine animals and would be willing to help rehabilitate marine mammals in a spill. They have veterinarian staff and rehabilitation facilities.

DEFF assets will be mobilised to assist a major wildlife response if required. The DEFF marine mammal team and coastal research team would be mobilised. The Society for the Prevention of Cruelty to Animals (SPCA) can further be requested to assist for larger marine species. The SPCA will further be required to guide the disposal or incineration of animal carcases.

# 6. Risk Assessment

The oil spill risk assessment is an important phase of the gap analysis and is used to identify whether the tiered response capability in place is appropriate for the risks identified. Potential oil spill scenarios risks identified for the South Africa coastline and ports and harbours have been identified through documentation collected in advance of the site visits, and observation and conversations during the site visits. The resultant risk has been assessed by the project team.

## 6.1. National risk

The main oil pollution risks identified in South Africa that have the potential to cause significant impact are:

- vessels offloading crude oils and fuel oils at the offshore SBM;
- bunkering tanker;
- transiting vessels along the coastline having a collision/ grounding incident and a loss from the storage tanks
- tanker place of refuge for damaged tanker, with loss of oil from storage tanks.

## 6.2. Risk Assessment Methodology

To keep the capability review consistent across all SAPIA stakeholders, the same severity/likelihood definitions have been used for all stakeholders. The definitions of each category are provided in Table 8 and Table 9. The resulting assessment is presented in the Risk Register in Table 10.

**Table 8 Description of Severity**

| Level of Severity | Description of Severity – Environmental |
|---|---|
| 1 Low | Minor spill with no observable or measurable damage on habitats, species or ecosystem services. |
| 2 Medium Low | Moderate spill within site limits or immediate proximity causing observable or measurable short-term and reversible degradation on habitats, species or ecosystem services. |
| 3 Medium | Serious spill affecting the site vicinity or third parties causing important observable or measurable damage on habitats, species or ecosystem services. |
| 4 High | Major pollution extending beyond the site and its vicinity causing very serious and long-term environmental damage on habitats, species or loss of ecosystem services with respect to ground state. High probability of observable or measurable permanent residual damage on ecosystem services. |
| 5 Very High | Catastrophic and widespread pollution with irreversible environmental consequences. Observable or measurable permanent damages on habitats, species or loss of ecosystem services despite applying remediation measures. |

**Table 9 Description of Likelihood**

| Likelihood | Description of Likelihood |
|---|---|
| 1 Remote | Remote chance of happening. Very rare combination of factors. |
| 2 Possible | May happen less than once during the facility/project lifetime/considered time period. Rare combination of factors. |
| 3 Likely | Expected to occur in the facility/ project lifetime/ considered time period. |
| 4 Very Likely | Expected to occur several times in the facility/ project lifetime / considered time period. |
| 5 Almost Certain | Occurs once or more per year in the facility/ project lifetime / considered time period. |

## 6.3. Risk Register

Risk assessment scenarios for the South African coastal zone are shown below. They do not represent every single scenario that could occur but are representative of the range and scale of scenarios that could lead to an oil spill. The risk assessment scenarios are partly derived from information collected from SAPIA stakeholders and TNPA (and written for this assessment), and partly taken from the oil spill contingency plans submitted to the project team, a full list of documents reviewed can be found in Appendix 3.

**Table 10 Oil Spill Risk Scenarios – South Africa Ports**

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | All Ports | Mechanical equipment on vessel or jetty | Small operational spill | Various – lube oil, diesel, hydraulic oil | < 10 litres | Minimal – sheen on water surface | 5 | 1 | L | • Monitoring, contain on deck/land where possible, assisted natural dispersion. |
| 2 | Any area along the coastline of South Africa, especially the Agulhas bank. | Vessel | Bilge pumping | Various – lube oil, diesel, hydraulic oil | < 500 litres | Sheen and oiling around pumping location and surrounding area. Severity will be dependent on oil type and location. Potential for oil to reach Agulhus Bank complex protected area. | 4 | 2 | M | • Monitoring and assisted natural dispersion. |
| 3 | All Ports | Loading/ offloading vessels | Hose rupture | Various – bunker fuel oil, petrol, diesel | 15-20 $m^3$ | Sheen and oiling around pumping location and surrounding area. | 2 | 2 | L | • Monitor and evaluate.<br>• Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing. |

[8] For more information on these techniques refer to Appendix 2.

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | • Protection of sensitive resources.<br>• Shoreline clean-up. |
| 4 | All Ports | Vessel – shore to ship refuelling | Fuel transfer spill: leaking valve whilst refuelling vessel | HFO / IFO / MGO | < 1 $m^3$ | Oiling around jetty and within natural collection point in harbour. | 3 | 2 | L | • Assisted natural dispersion if MGO.<br>• Containment and recovery with mechanical recovery or vacuum trucks for HFO/IFO. |
| 5 | All Ports | Vessel – shore to ship refuelling | Fuel transfer spill: split hose whilst refuelling vessel. | HFO / IFO / MGO | 25 $m^3$ | Could overwhelm harbour protection to cause oiling within wider port area. | 2 | 2 | L | • Assisted natural dispersion if MGO.<br>• Containment and recovery with mechanical recovery or vacuum trucks for HFO/IFO.<br>• Potential shoreline clean-up. |
| 6 | All Ports | Vessel – ship to ship refuelling | Fuel transfer spill: leaking valve whilst refuelling vessel | HFO / IFO / MGO | < 1 $m^3$ | Some ports have preventative booming in place. Others do not ( (hence severity of 2) | 3 | 2 | L | Lighter fuel oils (MGO):<br>• assisted natural dispersion<br>• attempt to recover with an oleophilic skimmer if enough volume.<br>Heavier fuel oils (IFO/HFO):<br>Boom and recovery by mechanical skimmer. |
| 7 | Port Elizabeth, Algoa Bay | Vessel – ship to ship refuelling | Fuel transfer spill: split hose whilst refuelling vessel | HFO / IFO / MGO | 4 $m^3$ | May be partially contained by boom if preventative booming in place at bunkering site. If boom fails/or not in place, then it could spread to aquaculture areas. | 2 | 3 | M | Lighter fuel oils (MGO):<br>• assisted natural dispersion<br>• recovery with oleophilic skimmer<br>Heavier fuel oils (IFO/HFO):<br>Boom and recover by mechanical skimmer. |
| 8 | Any area along the | Vessel | Grounding/ collision with loss of oil from | HFO / IFO | 500 $m^3$ | Spread from accident site to wider area. Severity dependant | 2 | 3 | M | • Monitoring and surveillance to determine spill spread. |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | coastline of South Africa | | fuel storage tank(s) | | | on spill location and spread. | | | | • Dispersant in suitable areas for IFO (if oil is amenable and the location is within limits for use of dispersants).<br>• Containment and recovery with mechanical recovery or vacuum trucks for HFO.<br>• Potential shoreline clean-up. |
| 9 | The Aghulus bank (Hotspot area for spills) | Vessel | Loss of steerage resulting in loss of oil from fuel storage tank(s) | HFO / IFO | 100 $m^3$ | Spread from accident site to wider area. Severity dependant on spill location and spread. | 3 | 3 | M | • Monitoring and surveillance to determine spill spread.<br>• Dispersant in suitable areas for IFO (if oil is amenable and the location is within limits for use of dispersants).<br>• Containment and recovery with mechanical recovery or vacuum trucks for HFO.<br>• Potential shoreline clean-up. |
| 10 | Any area along the coastline of South Africa | Tanker | Grounding/ collision with loss of oil from crude single storage tank | Crude | 25 000 $m^3$ | Spread from accident site to wider area. Severity dependant on spill location and spread. Potential for oil to reach Langebaan lagoon. | 2 | 4 | M | • Monitoring and surveillance to determine spill spread.<br>• Dispersant in suitable areas (if oil is amenable and the location is within limits for use of dispersants).<br>• Containment and recovery.<br>• Potential shoreline clean-up. |
| 11 | Saldanha | Tanker – inside port | Grounding/ collision inside port areas with loss of oil from storage tanks. | Crude | 100 000 $m^3$ | Major impact in and around spill location and surrounding sites. Potential for oil to travel great distance. Severity of 5 assumes that oil | 2 | 5 | H | • Monitoring and surveillance to determine spill spread.<br>• Dispersant in suitable areas (if oil is amenable).<br>• Containment and recovery.<br>• Potential shoreline clean-up. |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | spreads in Langebaan lagoon. | | | | |
| 12 | Any area along the coastline of South Africa | Tanker – outside port | Grounding/ collision outside port areas with loss of oil from storage tanks. | Crude | 100 000 $m^3$ | Major impact in and around spill location and surrounding sites. Potential for oil to travel great distance. | 2 | 4 | M | • Monitoring and surveillance to determine spill spread.<br>• Dispersant in suitable areas (if oil is amenable).<br>• Containment and recovery.<br>• Potential shoreline clean-up. |
| 13 | Any area/port along the coastline of South Africa | Tanker – place of refuge | Place of refuge for damaged tanker, with loss of oil from storage tanks. | Crude | 100 000 $m^3$ | Major impact in and around spill location and surrounding sites. Potential for oil to travel great distance. | 1 | 5 | H | • Monitoring and surveillance to determine spill spread.<br>• Dispersant in suitable areas (if oil is amenable).<br>• Containment and recovery.<br>• Potential shoreline clean-up. |
| 14 | Saldanha and Durban | Loading/ offloading jetty/SBM | Loading arms/hose minor failure | Crude | 1 $m^3$ | Sheen and oiling around jetty/SBM and surrounding area. | 3 | 2 | L | • Monitoring and assisted natural dispersion. Containment and recovery - skimming to recover oil should be possible – skimmer type will depend on crude viscosity. |
| 15 | Saldanha | Loading/ offloading jetty | Loading arms major failure | Crude | 300 $m^3$ based on a maximum pumping rate of 12 000 $m^3$ / hour x 90 secs to shut down. | Affecting aquaculture area. Shoreline oiling within Saldanha Bay. Possible shoreline oiling in Langebaan lagoon. | 2 | 3 | M | • Monitoring and surveillance to predict spill spread.<br>• Containment and recovery of oil on water surface.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |
| 16 | Saldanha and Durban | Tanker at loading/ | Leaking seals/valves | Crude | <1 $m^3$ | Sheen and oiling around jetty/SBM | 4 | 1 | L | • Containment and recovery - all oil should be contained within the protection boom so skimming to |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | offloading jetty/SBM | | | | and closely surrounding area. | | | | recover oil should be possible – skimmer type will depend on crude viscosity.<br>• Monitoring and assisted natural dispersion. |
| 17 | Saldanha and Durban | Loading/ offloading jetty/SBM | Pipeline failure with partial loss of line volume | Crude | 2.5 $m^3$ | Sheen and oiling around jetty/SBM and closely surrounding area. | 3 | 2 | L | • Monitoring and assisted natural dispersion.<br>• Containment and recovery |
| 18 | Saldanha | Loading/ offloading jetty | Vessel collision with jetty – loss of pipeline volume | Crude | 203 $m^3$ based on a 20" line and 1 km length | Affecting aquaculture area. Shoreline oiling within Saldanha Bay. Possible shoreline oiling in Langebaan lagoon. | 2 | 3 | M | • Monitoring and surveillance to predict spill spread.<br>• Containment and recovery of oil on water surface.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |
| 19 | Cape Town | Loading/ offloading at berths 1 and 2 and Eastern Mole 2 | Loading arms major failure | Various (including jet A1, gasoil, diesel, HFO, vegetable oils) | 267 $m^3$ based on an estimated pumping rate of 8 000 $m^3$ / hour x 2 mins to shut down. | Affecting port operations and possible spread outside Cape Town harbour. Likely to affect tourism and could affect bird populations at Robben Island. | 2 | 3 | M | • Monitoring and surveillance to predict spill spread.<br>• Containment and recovery of oil on water surface for heavier oils. Assisted natural dispersion (whilst gas monitoring) for lighter oils.<br>• Protection of sensitive resources.<br>• Shoreline clean-up.<br>• Wildlife response. |
| 20 | Cape Town | Loading/ offloading jetty | Vessel collision with jetty – loss of pipeline volume | Crude | 162 $m^3$ based on a 20" line and 200m length | Shoreline oiling within Cape Town area. Possible impact to Robben Island. | 2 | 3 | M | • Monitoring and surveillance to predict spill spread.<br>• Containment and recovery of oil on water surface.<br>• Protection of sensitive resources. |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | • Shoreline clean-up. |
| 21 | Mossel Bay | Storage tank at Voorbaai tank farm | Loss of primary and secondary containment of multiple tanks caused by tropical cyclone | Various – mostly condensate, with diesel, petrol, kerosene | Largest tank is 17 200 $m^3$. Assume multiple tanks damaged with partial loss to sea: 10 000 $m^3$. | Light oiling of several sandy amenity beaches (Pansy beach, Diaz Beach, Diasstrand, Baydunes, Hartenbos Beach, Ronin Erasmus Beach), wavecut rocky platforms and breeding sites (Hartenverbos river mouth and Brak river mouth). Sea birds. | 1 | 4 | M | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread.<br>• Containment and recovery of oil on water surface for gross contamination if safe. Recovery with oleophilic skimmer.<br>• Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up.<br>• Wildlife hazing |
| 22 | Cape Town | Storage Tank | Loss of primary containment | HFO / IFO / MGO | 5 000 $m^3$. Assuming a spill of 25 000 $m^3$, with 20% loss to sea. | Major impact in and around spill location and surrounding sites. | 1 | 3 | L | • Monitoring and surveillance to determine spill spread.<br>• Assisted natural dispersion and/or sorbent boom sweeps if MGO.<br>• Containment and recovery with mechanical recovery or vacuum trucks for HFO.<br>• Potential shoreline clean-up. |
| 23 | Port Elizabeth | Bunkering tanker in Algoa Bay | Grounding / collision in Algoa Bay with loss of oil from storage tanks. | HFO / IFO / MGO | 6 600 $m^3$ | Effect will depend on type of oil spilt. MGO would have a moderate effect as it is likely to disperse naturally. A heavier oil such as IFO would | 2 | 5 | H | • Monitoring and surveillance to determine spill spread.<br>• Dispersant in suitable areas (if oil is amenable).<br>• Containment and recovery.<br>• Potential shoreline clean-up.<br>• Wildlife response and clean-up |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | persist for much longer and is likely to emulsify. The severity of the spill will depend on the spill location, but in extreme cases could affect marine reserves/ endangered bird species nesting and feeding sites – Algoa Bay is one of the most sensitive sites environmentally. For this reason it has been assigned the highest severity. Will affect tourism. | | | | |
| 24 | Durban | Storage tank at Island View | Loss of primary and secondary containment of multiple tanks caused by tropical cyclone | Various – LPG, bunker fuel oil, petrol, diesel | Assume multiple tanks damaged with partial loss to sea: 10 000 $m^3$. | Oiling sandy amenity areas including: Cave Rock, Ocean View, Isipingo Beach, Merwent, Amanzimtoti Beach, Kingsburgh Beach, Illovo Beach, Umgababa Beach, Palm Cliff, Freeland Park and Scottburgh. Cyclone likely to | 1 | 4 | M | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread.<br>• Containment and recovery of oil on water surface for gross contamination if safe. Recovery with oleophilic skimmer.<br>• Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | assist natural dispersion of oil. | | | | |
| 25 | Durban | Tanker at SBM | Tanker fire on approach to berthing at the SBM resulting in total loss of oil tanker's cargo | Crude | 318 000 $m^3$ (2M bbls) | Extensive coastline oiling. Oiling of sandy amenity areas including: Isipingo Beach, Merwent, Amanzimtoti Beach, Kingsburgh Beach, Illovo Beach, Umgababa Beach, Palm Cliff, Freeland Park and Scottburgh. Oiling of Marine Protected Areas and Durban Harbour. | 1 | 5 | H | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread.<br>• Dispersant test spray and effectiveness test. Use if effective. Continue with dispersant application until no longer effective.<br>• Containment and recovery of oil on water surface for gross contamination.<br>  ○ Lighter fuel oils (MGO) attempt to recover with an oleophilic skimmer if enough volume.<br>  ○ Heavier fuel oils (IFO/HFO) recover by mechanical skimmer.<br>• Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |
| 26 | Mossel Bay | Tanker en-route to SPM incident with another vessel. | Collision with partial loss of PetroSA cargo from oil cargo storage tank(s) | Petrol, diesel, kerosene, condensate, reformate | 20 000 $m^3$ | Spread from accident site to surrounding area. Severity dependant on spill location and spread. | 1 | 4 | M | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread.<br>• Attempt to recover with an oleophilic skimmer if enough volume. |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Energy of environment likely to cause natural dispersion. | | | | • Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |
| 27 | Durban | Tanker at SBM | Tanker collision /grounding with moored tanker or SBM resulting in total loss of oil from tankers largest cargo tank | Crude | 20 500 $m^3$ | Large area of coastline impacted including rivers, Marine Protected Areas and Durban Harbour. International media and government interest guaranteed | 1 | 4 | M | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread.<br>• Dispersant test spray and effectiveness test. Use if effective. Continue with dispersant application until no longer effective.<br>• Containment and recovery of oil on water surface for gross contamination.<br>  ○ Lighter fuel oils (MGO) attempt to recover with an oleophilic skimmer if enough volume.<br>  ○ Heavier fuel oils (IFO/HFO) recover by mechanical skimmer.<br>• Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |
| 28 | Durban | SBM floating hose | Hose rupture during full discharge operations (due | Crude | 318 $m^3$ | Large area of coastline impacted including rivers, Marine Protected | 2 | 3 | M | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread. |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | to parting of mooring ropes/chafe chains or slipping of chains in stoppers) | | | Areas and Durban Harbour. Possible national media interest. | | | | • Dispersant test spray and effectiveness test. Use if effective. Continue with dispersant application until no longer effective.<br>• Containment and recovery of oil on water surface for gross contamination.<br>• Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |
| 29 | Durban | Storage tank at SAPREF refinery | Loss of primary and secondary containment of multiple tanks caused by tropical cyclone | Crude | Assume multiple tanks damaged with partial loss to sea: 10 000 $m^3$. | Oiling sandy amenity areas including: Isipingo Beach, Merwent, Amanzimtoti Beach, Kingsburgh Beach, Illovo Beach, Umgababa Beach, Palm Cliff, Freeland Park and Scottburgh. Cyclone likely to assist natural dispersion of oil. | 1 | 4 | M | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread.<br>• Containment and recovery of oil on water surface for gross contamination if safe. Recovery with oleophilic skimmer if light crude.<br>• Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |
| 30 | Mossel Bay | Pipeline rupture | Anchor damage to carrier pipelines and all 3 internal pipelines from | Petrol, diesel, kerosene, condensate, reformate | 293 $m^3$<br><br>Assume 50% loss of 14" and 12" pipelines. | Oiling several sandy amenity beaches (Pansy beach, Diaz Beach, Diasstrand, Baydunes, Hartenbos Beach, Ronin | 2 | 3 | M | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread.<br>• If oil can be contained quickly before large spreading, then containment and recovery of oil on water surface |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | SPM to Voorbaai. | | | Erasmus Beach), wavecut rocky platforms and breeding sites (Hartenverbos river mouth and Brak river mouth). Sea birds, desalination plant. | | | | for gross contamination. Recovery with oleophilic skimmer.<br>• Natural dispersion (whilst gas monitoring) for lighter oiling/sheen assisted by prop washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up / surf washing. |
| 31 | Durban | Pipeline from SBM to refinery | Damage/failure of underground pipeline due to dropped anchor/vessel hitting into pipeline resulting in loss of pipeline contents | Crude | 3 150 $m^3$ | Large area of coastline impacted including rivers, Marine Protected Areas and Durban Harbour. International media and government interest guaranteed | 2 | 3 | M | • Monitor and evaluate.<br>• Aerial surveillance to predict spill spread.<br>• Dispersant test spray and effectiveness test. Use if effective. Continue with dispersant application until no longer effective.<br>• Containment and recovery of oil on water surface for gross contamination.<br>• Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |
| 32 | Richards Bay | Storage tanks. | Loss of primary and secondary containment of multiple tanks caused by tropical cyclone. | HFO / IFO / MGO | Assume multiple tanks damaged with partial loss to sea: 5 000 $m^3$. | MGO could cause localised in-water toxicity which could affect fish spawning and juvenile fish areas round the port. HFO would persist and could cause | 1 | 4 | M | • Monitor and evaluate (aerial surveillance, trajectory modelling to predict spill spread and visualisation).<br>• Containment and recovery of oil on water surface for gross contamination if safe. Recovery with skimmer suitable to the oil type. |

| # | Location | Source | Event | Oil Type | Spill Volume | Potential Environmental Effect | Likelihood | Severity | Risk | Suitable Response Techniques[8] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | oiling of the mangrove areas around the port, as well as affecting port operations. Cyclone likely to assist natural dispersion of oil for MGO but cause emulsification of HFO. | | | | • Natural dispersion (whilst gas monitoring) for lighter oils, assisted by prop washing and surf washing.<br>• Protection of sensitive resources.<br>• Low pressure water flushing to remove oil from sensitive areas.<br>Shoreline clean-up. |
| 33 | Richards Bay | Bunkering vessel in Richards Bay harbour. | Grounding / collision in Richards Bay harbour with loss of fuel oil from storage tanks. | HFO / IFO / MGO | 3 800 $m^3$. | Persistent spill with significant damage. Oiling of mangrove areas within the port. Mangroves unlikely to recover in the short term hence the severity of 4. Will affect port operations and have a potential effect on tourism. | 2 | 4 | M | • Monitor and evaluate (aerial surveillance, trajectory modelling to predict spill spread and visualisation).<br>• Containment and recovery of oil on water surface for gross contamination - recover by mechanical skimmer.<br>• Protection of sensitive resources.<br>• Shoreline clean-up. |

## 6.4. Risk Assessment Matrix

The matrix below shows how the likelihood and severity classes have been used to rank the different scenarios as high, medium or low risk.

**Table 11 Risk matrix for South African scenarios**

| | | Likelihood | | | | |
|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** |
| **Severity** | **1** | | | | 11, 16 | 1 |
| | **2** | | 3, 5 | 4, 6, 14, 17 | 2 | |
| | **3** | 22 | 7, 8, 15, 18, 19, 20, 28, 30, 31 | 9 | | |
| | **4** | 21, 23, 24, 26, 27, 29, 32 | 10, 12, 33 | | | |
| | **5** | 13, 25 | 11, 23 | | | |

| **Scenario risk colour coding** | | |
|---|---|---|
| High | Medium | Low |

## 6.5. Risk Assessment Summary

The risk assessment matrix demonstrates that South Africa's highest risk comes from the following:

- Tanker inside a port grounding / collision with loss of oil from storage tanks. Expected worst case loss of 100 000 $m^3$ of crude oil.
- Tanker place of refuge for damaged tanker, with loss of oil from storage tanks. Expected worst case loss of 100 000 $m^3$ Expected worst case loss of 100 000 $m^3$ of crude oil.
- Bunkering tanker in Algoa Bay grounding / collision with loss of oil from storage tanks. Expected worst case loss of 6 600 $m^3$ of crude oil.
- Tanker at Durban SBM fire on approach to berthing at the SBM resulting in total loss of oil tanker's cargo. Expected worst case loss of 318 000 $m^3$ of Crude oil, IFO or MGO.
- Storage tank loss from primary containment at Island View, Durban. Expected worst case loss of 10 000 $m^3$ to sea.

# 7. Gap Analysis

## 7.1. Legislation, Regulations and Agreements

A range of legislation is in place in South Africa relating to oil spills. Based on a review of the information provided and from discussions during the site visit, the following comments and gaps have been identified in Table 12 below.

**Table 12 Gaps Identified for Legislation, Regulations and Agreements**

| Gap Classification | Category | Gap | Explanation | Recommendation | Ref # |
|---|---|---|---|---|---|
| Moderate | National Dispersant Policy (in draft) | No published list of approved dispersants or clear explanation of which dispersants would be allowed. | The draft dispersant policy references products approved by France, Australia, UK and USA as being considered but no list or clear criteria for dispersant acceptance is in place.<br>If a large spill were to occur and the responsible party wanted to mobilise dispersants from international stocks they would need to know which type of dispersant to mobilise. | Make wording clearer in the policy for how to establish if a dispersants is approved for use i.e. listed on 2 of 3 country approved lists, make reference to the websites these up-to-date lists can be sourced from. This is the responsibility of DEFF. | N1 |
| Moderate | Dispersant approval once an oil spill has occurred. | There is no clear approval process to follow to get approval for dispersant use in a spill. | For spraying of dispersants, time is a crucial factor. There is often a narrow window of opportunity over which dispersant use may be effective. If a decision is not taken quickly, then this is in effect as decision not to spray. The time of an incident is not the time to start considering this issue. This should be done in advance, at the oil planning stage. The draft dispersant policy identifies that a NEBA is required but there is no example NEBA form and it is not clear if the operator or DEFF will conduct the NEBA. | If an operator should be conducting the NEBA as part of an application to spray dispersant then provide a NEBA assessment form in the draft dispersant guidance. Continue to test approval process with different parties during oil spill exercises.<br>Spill dispersant approvals should be available 24/7 and receive rapid acceptance or rejection. | N2 |
| Moderate | Dispersant pre-approval for use | The draft policy states dispersant can be used outside specified limits if preapproval for dispersant use has been incorporated into the relevant contingency plan but operators were unclear | Operators were unclear as to if their own resource was included within their plan, they could automatically use it in a spill.<br><br>Confusion over pre-approval only being given to Tier one spills when dispersant would be required for larger scale spills. | Operations with a known higher risk of shoreline oiling of should have pre-approval for dispersant use under given conditions and suitable oil types. We understand that since the time of the visit this has been granted in some cases. | N3 |

| Gap Classification | Category | Gap | Explanation | Recommendation | Ref # |
|---|---|---|---|---|---|
| | | about the process. | | Wording in the policy regarding Tiers spills needs to be reworded and defined as tiered capability. | |
| **Major** | Response to shipping spill | Not clear who would do the offshore response (containment and recovery and/or dispersant) of oil spilt from a ship offshore. | One of the main risk areas is a shipping spill and south Africa is not set up to deal with this.<br>The P&I clubs would cover the costs of the vessel and clean up, SAMSA would lead on incident management, but there is no trained workforce who would do the offshore clean- up. | Arrange trained workforce who would do the physical clean-up for oil spills on water outside harbour areas. | **N5** |
| **Minor** | Area of response jurisdiction | Transnet National Ports Authority (TNPA) have jurisdiction over their individual port areas which typically stretch 3-5 miles from the main harbour port areas. | There was a variation in where different TNPA port authorities saw their area of responsibility to respond to an oil spill. Some saw their area of responsibility to respond to oil spills to match the wider port area where they would take vessel tracking system (VTS) control of a vessel. Most saw their oil spill response area to be the inner port area only – usually up to a harbour breakwater. This latter viewpoint is backed up by TNPA management. | TNPA and SAMSA to clarify actions of outer port areas. Suggest this is tested in an exercise. | **N6** |

## 7.2. Tiered Preparedness and Response Capability

**Table 13 Gaps Identified in Tiered Response Capability**

| Gap Classification | Category | Gap | Explanation | Recommendation | Ref # |
|---|---|---|---|---|---|
| Major | Response Responsibility | Not clear who would respond to an oil spill response for a large-scale incident. | DEFF has responsibility for combating pollution of the sea and shoreline by oil however they have very limited personnel which restricts their ability to lead a large-scale response. Their equipment stockpile is tailored towards shoreline/nearshore response. If DEFF are to lead an at-sea response they need designated resources and enough trained personal to do this. Whilst SAMSA would manage a large at-sea response, they have no resources to actually clean up oil pollution. | Ensure that at sea resources and enough hands-on personnel are available in a large-scale incident. | N7 |
| Moderate | At sea Containment and Recovery | The only equipment available for the collection and recovery of free-floating mobile oil was seen in Saldanha and is not a national on call resource. | Whilst containment and recovery with a towed boom is not suitable in rough conditions, it would be suitable in calmer waters/calmer conditions. | Ensure oil spill response provision includes suitable equipment for the collection of free-floating oil with boom and skimmers appropriate for the oil type. | N8 |
| Moderate | Wildlife Response | Operators do not have guaranteed access to any wildlife response resources. | Wildlife response organisations exist in South Africa, but they are not an oil industry resource and will always have to balance limited competing resources. | Arrange Tier 1 and Tier 2 oiled wildlife preparedness and response capability through oiled wildlife preparedness and response retainer agreements with OWR organisations. | N9 |
| Minor | Wildlife plan | Wildlife plan is in draft and subplans are being written but not yet complete/some are not yet written. | The current wildlife plan is in draft. More operational detail on wildlife response will be included in the subplans, which are partly written. | Finalise wildlife plan and subplans with more detail on how oiled wildlife would be managed in a response. | N10 |
| Major | Dispersant | No dispersant, or trained responders | Dispersant is described as one of the most suitable oil response | Arrange dispersant stocks, guaranteed access spray equipment | N11 |

| Gap Classification | Category | Gap | Explanation | Recommendation | Ref # |
|---|---|---|---|---|---|
| | | are available nationally. | techniques in the NOSCP. Subject to the dispersant guidance conditions including depth and distance to shore (see Table 4), dispersant would be suitable for a medium viscosity oil spill that will not disperse on its own. | and trained operators at strategic points on the South African coastline. A maintenance programme then needs to be put in place to maintain this equipment. | |
| **Minor** | Dispersant Monitoring | Standards required for dispersant monitoring are not defined. | Chapter 6 of the draft dispersant policy requires monitoring of effectiveness and efficiency of dispersant during its use. The details required for monitoring are not defined. | The dispersant policy should identify standards so any responsible parties intending to use dispersant can ensure they implement an adequate monitoring program with equipment they can access. | **N12** |
| **Major** | Aerial Surveillance | No trained aerial surveillance observers | Helicopters could be re-tasked in a spill to provide aerial surveillance but there are no agency or operator staff trained in surveillance. | At a national level, trained aerial surveillance responders should be available and on call. | **N13** |
| **Moderate** | Aerial Surveillance | No dedicated aircraft for aerial surveillance. | There is no resource dedicated for oil spill response surveillance that can be called upon at short notice. | At a national level, a suitable aircraft should be available at short notice for aerial surveillance. Test mobilisation of UAVs to an area outside Cape Town in an exercise. Ensure that any documentation required for flight mobilisation including logistical requirements, required dangerous good notes etc are in place. | **N14** |
| **Major** | Equipment commissioning | Lack of commissioning of oil spill response equipment. | The Navy, DEFF, and TNPA all had equipment that had not been unpacked and commissioned. This equipment is not response ready. Equipment that is not stored properly (such as being folded in the same position) will degrade | All oil spill providers should have response ready equipment that is commissioned, has all ancillaries stored, maintained and exercised. | **N15** |

| Gap Classification | Category | Gap | Explanation | Recommendation | Ref # |
|---|---|---|---|---|---|
| | | | even if it has not been used. | | |
| **Major** | Equipment maintenance and storage | Lack of maintenance of oil spill response equipment. | Some of the DEFF and TNPA equipment needs cleaning and maintenance before it is response ready. All equipment should be started, checked and perishables (rubber seals, etc.) replaced as appropriate. | Ensure all equipment is regularly maintained (DEFF maintenance schedules not checked as part of this review). Clearly mark equipment for decommissioning. | **N16** |
| **Major** | Equipment maintenance and storage. | Inadequate storage of oil spill response equipment. | The DEFF equipment warehouse was in the process of being changed. Current storage does not allow for easy access to the equipment. Ancillary equipment (e.g. hoses / air blowers) should be stored so they are easily accessible with the main equipment. Equipment lists of all equipment with all required ancillaries should be produced so equipment packages are easily put together. | Equipment move to be completed and appropriate racked and labelled storage to be arranged. All equipment to be itemised and response ready status to be recorded. | **N17** |
| **Major** | Vessel availability | Vessels not available quickly for pollution response. | No dedicated vessels to spill response. Unclear of the availability of vessels for pollution response outside of port limits. There are vessels available but not dedicated to this role and unclear if they would be released for spill response cleanup operations (AMSOL & DEFF pollution response vessels have suitable vessels however they are tasked with other responsibilities). | Have either dedicated vessels for spill response and/or vessels that have another day-to-day function but are available to be called upon and be dedicated to this role. Such vessels must have adequate equipment onboard for pollution response. | **N18** |

## 7.3. Oil Spill Training and Exercise Programme

**Table 14 Gaps Identified for Oil Spill Training and Exercise Programmes**

| Gap Classification | Category | Gap | Explanation | Recommendation | Ref # |
|---|---|---|---|---|---|
| Moderate | Responder competency | Responders seen did not, in general, have a high level of oil spill response knowledge. | Tier 1 providers had varying levels of spill response knowledge. Whilst some were trained in health and safety there was very little knowledge of specialist oil spill response techniques. | Ensure that any spill response provider to responders is appropriately trained (IMO level 2 or equivalent). | **N19** |
| Moderate | Agency support | DEFF staff may not have the capacity to effectively support a large oil spill response. | Due to low staffing levels DEFF staff may not be able to support a response effectively/quickly enough. | Work with all agencies involved in oil spill response to ensure that appropriate support is available. | **N20** |
| Moderate | Exercises | Lack of familiarity with oil spill equipment. | In some ports, whilst we were told that oil spill exercises had taken place, equipment that clearly had not been used in a long time or had never been commissioned. Only one oil spill exercise report / exercise lessons learnt was seen during the visit and that was provided by an oil industry operator. | Ensure regular equipment deployment exercises are implemented in all ports so responders get familiar with using the equipment and can use it efficiently in a spill. Ensure exercise lessons learnt are captured and acted upon. | **N21** |
| Moderate | Training and exercise programme schedule | Training and exercise programmes were on the whole, not adequate based on industry standards. | Operators on the whole, did not appear to do regular training and exercises (there were some exceptions). No clear annual programmes in place and no evidence that the outcomes of the training and exercises are being used to update and improve the operators SSPRPs. | In line with the draft Marine Bill, operators and government bodies need readily available annual training and exercise programmes. | **N22** |

## 7.4. Other Observations

Several other key findings that sit outside the previously defined categories above were identified and are described in Table 15 below.

**Table 15 Other Spill Preparedness Gaps Identified**

| Gap Classification | Category | Gap | Explanation | Recommendation | Ref # |
|---|---|---|---|---|---|
| **Major** | Safety | Portable gas monitors were not seen in the majority of response equipment stockpiles across the ports. | Facilities and tankers will have fixed gas monitors on board, but initial oil spill responders are often going into areas that have evaporating hydrocarbons. With no gas monitors this is a safety concern. | Have suitable portable gas monitors for all response teams who may need to respond. | **N23** |
| **Major** | Safety | TNPA and DEFF facilities had no visible written procedures on how to operate equipment. | Standard operating procedures and work instructions reduce the risk of an accident when carrying out tasks. | Oil spill equipment owners should arrange work instructions for any mechanical equipment they hold. | **N24** |
| **Major** | Safety | The DEFF equipment stockpiles contained equipment with hydraulic hoses that had exceeded their testing and/or replacement dates. This might apply to the Navy equipment too. | Lack of maintenance has resulted in equipment being in various states of decay. In some cases, lack of maintenance has caused very decayed hydraulic hoses that would pose a risk to the operator of that equipment, or nearby personnel. | Equipment that is to be used should be well maintained to ensure safety. Implement a maintenance program for all equipment that includes hydraulic hose testing/replacement. Clearly mark any equipment awaiting decommissioning so it cannot be confused with 'in-use' equipment. | **N25** |
| **Moderate** | Contingency plan and risk assessments | Lack of detailed risk assessments and sufficient detail in plans based on the level of operator risks and National risks. | As a requirement of the Draft Marine Bill owners or operators of port facilities must have specific pollution contingency plans which are appropriate to the level and type of risk of marine pollution incidents resulting from their activities and must be consistent with the NOSCP. The draft Marine Oil Pollution Bill requires operators to produce site plans that detail measures to protect, rescue, rehabilitate and release wildlife affected in a marine pollution incident. | The general standard of operator plans needs improving to fall in line with the Bill requirements. | **N26** |

## 7.5. Tiered Response Capability

To visually summarise gaps and required capability, a tiered preparedness and response (TPR) wheel has been produced. Tiered preparedness and response is recognised as the basis on which to establish a robust oil spill preparedness and response framework[9]. The system uses 15 response planning categories. Figure 7 shows the TPR wheels. The wheels have been based on the capability information summarised in Table 7.

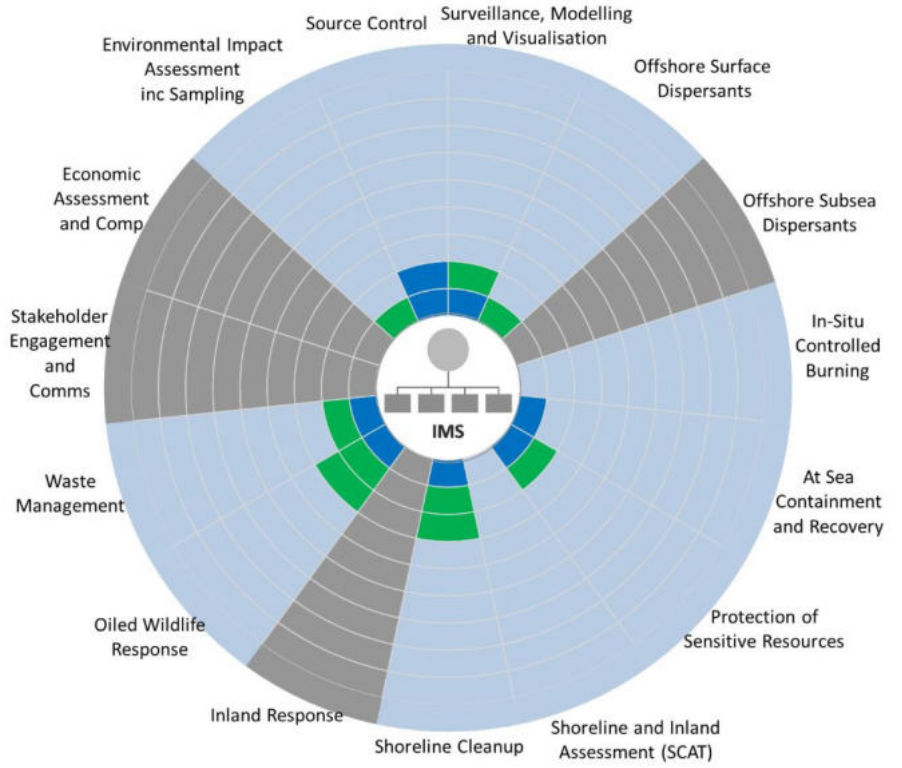
**Table 16 TPR wheel capability information**

| Response Technique | Capability | Gap |
|---|---|---|
| **Surveillance, modelling and visualisation** | Most oil operators have oil spill modelling capability. DEFF is in the process of developing an oil spill modelling tool for spills in South African waters. Helicopters are available for hire throughout coastal South Africa. Some ports have their own dedicated helicopter. These could be used for aerial surveillance. | No trained aerial surveillance responders available in country or dedicated surveillance aircraft. If the responsible party in a spill does not have oil spill modelling capability, the South African authorities would need to request international modelling support. |
| **Offshore surface dispersants** | Patrol boats with spray arms. Vessels are available at various ports that could be used as vessels of opportunity for dispersant spraying. | No viable dispersant or trained responders are available nationally. The patrol boats with spray arms are not dedicated to spill response. No approved dispersant list. No available equipment for dispersant effectiveness monitoring. |
| **Offshore subsea dispersants** | Not in scope of this review. | Not in scope of this review. |
| **In-situ controlled burning** | Vessels are available at various ports that could be used as vessels of opportunity for in-situ burning, though crew would need training in this response technique. | If the responsible party in a spill does not have access to in-situ burning equipment through a Tier 3 provider, the South African authorities have no national capability. This is considered a gap but not a priority. |
| **At sea containment and recovery** | Vessels are available at various ports that could be used as vessels of opportunity for at sea containment and recovery. At sea containment and recovery equipment available in Saldanha (OPSCA). Several operators have offshore skimmers. | Only one company in South Africa has any boom capable of being towed by a vessel. This is required to collect any free-floating oil spill. There was no evidence of at sea containment and recovery exercises. |

[9] Refer to IPIECA/IOGP (2015) Tiered preparedness and response: Good practice guidelines for using the tiered preparedness and response framework. IOGP report 526.

| Response Technique | Capability | Gap |
|---|---|---|
| **Protection of sensitive resources** | The coastal oil spill contingency plans identify protection priorities and DEFF would assist site protection prioritisation in a spill.<br>Sensitive resource protection equipment is available from operators and TNPA in various ports and from DEFF, in Cape Town. | No evidence of booming plans and exercises to practice protection booming of sensitive resources.<br>DEFF staff shortages mean limited support could be given. DEFF equipment requires maintenance and therefore is not response ready. |
| **Shoreline and inland assessment** | No capability in shoreline cleanup assessment technique (SCAT). | There are no SCAT trained responders in South Africa and they should be available. If the responsible party in a spill does not have access to SCAT trained responders, the South African authorities have no national capability. |
| **Shoreline cleanup** | Most operators and TNPA have small stockpiles of hand tools available. Further tools and skips are available from spill response contractors and national suppliers. DEFF have carried out shoreline training with key municipalities.<br>Recovery equipment is available from DEFF in Cape Town. | Trained people (to beachmaster level) to supervise responders doing shoreline cleanup, are not available.<br>DEFF equipment is not response ready. |
| **Inland response** | Not in scope of this review. | Not in scope of this review. |
| **Oiled wildlife response** | SANCCOB can support oiled wildlife response for oiled seabirds nationally having seabird rehabilitation centres in both the Western Cape and the Eastern Cape. Other organisations (notably uShaka Marine World, Two Oceans Aquarium and Bayworld) could support rehabilitation of other species.<br>Management authorities (including SANParks and CapeNature) would usually be responsible for search and capture. Field stabilisation can be done by trained SANCCOB and Management Authority staff. | Operators do not have any tier 1 resources for wildlife response.<br>There are no Tier 2 oiled wildlife preparedness and response capability agreements so there is no guaranteed oiled wildlife capability in a spill.<br>No operational oiled wildlife contingency planning and training. |
| **Waste management** | There are companies that are authorised to handle hazardous waste which already hold contracts with oil industry members. | Most operators did not have an oil spill waste management procedure.<br>No remediation schemes available in country for oiled waste so solid oiled waste would go to landfill. |

| Response Technique | Capability | Gap |
|---|---|---|
| | Several organisations hold temporary waste storage equipment.<br>The coastal oil spill contingency plans identify hazardous waste landfill sites. | The authorities believe that the capacity and operational availability of waste management sites is not enough for a large oil spill (especially in the Eastern and Northern Cape).<br>Waste management plan has not been finalised (still in development). |
| **Stakeholder engagement and communications** | Not assessed | Not assessed |
| **Economic assessment and compensation** | Not assessed | Not assessed |
| **Environmental impact assessment including sampling** | DEFF would support response assessment. Environmental Impact Assessment were not reviewed. | No evidence of any oil spill sampling and monitoring plans. |
| **Source control** | Preventative measures are in place for source control eg monitoring of loading operations. Operator sites were generally bunded and lessons had been learnt from previous spills (eg stormwater channels are usually closed off). Preventative booming was in place for some operations (but not all).<br>Harbour containment equipment (bubble screens/harbour boom) is in place at some ports. | Harbour containment equipment was not tested regularly and personnel did not take part in regularly exercises with this equipment. |

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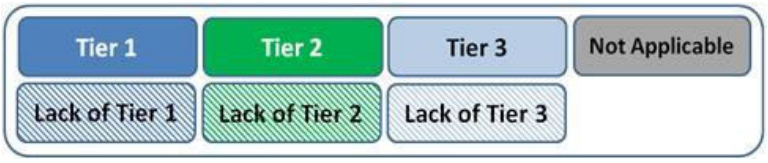


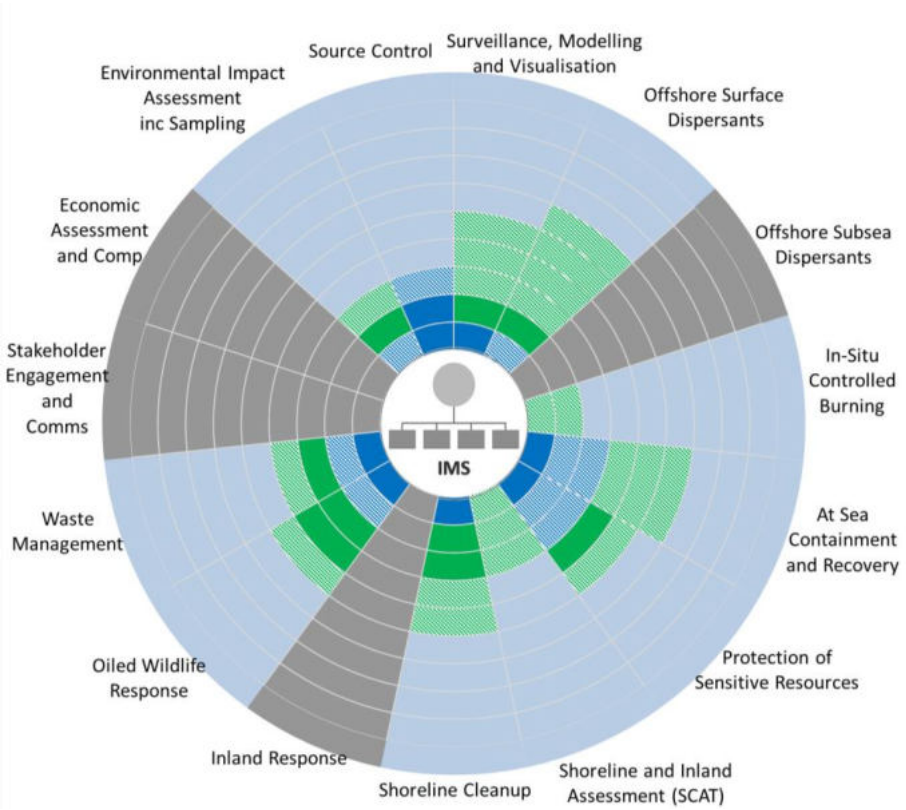


**Figure 17 Tiered Preparedness and Response Status – South Africa**

# Appendix 1 List of Documents Reviewed

The following documents have been reviewed for each port operation.

Saldanha:

- The Port of Saldanha Oil Spill Contingency Plan
- SFF Emergency Procedure- Saldanha
- SFF Oil Spill Contingency Plan- Saldanha
- Coastal Oil Spill Contingency Plan no 2: Swartland Zone

Cape Town:

- Astron Energy (formerly Chevron) SA Cape Town Harbour Industry Oil Spill Response Plan (2016)
- Spill Tech Oil Spill Response Plan Port of Cape Town- Tanker Basin
- Astron Energy Joint Bunkering Services (JBS) Oil Spill Response Plan- Cape Town Harbour (2018)
- Astron Energy Cape Town Refinery Emergency Response – Ballast and TB1&2 Procedure
- TNPA Port of Cape Town Oil Spill Contingency Plan
- Coastal Oil Spill Contingency Plan no 3: Cape Zone

Mossel Bay:

- The Marine Oil Spill Contingency Response Plan Mossel Bay for PetroSA offshore and near shore activities.
- Coastal Oil Spill Contingency Plan no 7: Mossel Bay Zone

Port Elizabeth / Ngqura (Coega):

- Astron Energy Coastal Terminals Oil Spill Response Plan 2019
- TNPA Port of Elizabeth Harbour Spill Contingency Plan and working manual
- Coastal Oil Spill Contingency Plan no 10: Dias Zone

East London:

- Astron Energy Coastal Terminals Oil Spill Response Plan 2019
- TNPA Port of East London Oil Spill Contingency Plan
- Coastal Oil Spill Contingency Plan no 12: Amathole Zone

Durban:

- SBM Oil Spill Contingency plan
- Transnet National Ports Authority, Port of Durban Oil Spill Contingency Plan 2019
- Coastal Oil Spill Contingency Plan no 20: Durban Zone

Richards Bay:

- Engen Emergency response and business recovery plans
- TNPA Port of Richards Bay pollution response contingency plan
- Engen Environmental Management Plan
- Coastal Oil Spill Contingency Plan no 24: Richards Bay Zone