Santos

Barossa

Production Operations Oil Pollution Emergency Plan

December 2024

Document No.: BAS-210 0134

Barossa

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2			

Rev	Rev Date	Author / Editor	Amendment
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Santos Company Site Representative (CSR)	link only
IMT Room – Perth office	●
AMOSC	●
NT DEPWS	●
WA DoT	●
AMSA	●
OSRL	●

Contents

Tables

Figures

List of acronyms

Abbreviation	Definition
AEP	Australian Energy Producers (formerly Australian Petroleum Production and Exploration Association [APPEA]; from 13 September 2023)
AFMA	Australian Fisheries Management Authority
AIS	Automatic identification system
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMP	Australian Marine Park
AMSA	Australian Marine Safety Authority
API	American Petroleum Institute
APPEA	Former Australian Petroleum Production & Exploration Association (to 12 September 2023; now Australian Energy Producers [AEP])
AUV	Autonomous Underwater Vehicle
BAOAC	Bonn Agreement Oil Appearance Codes
BER	Boom Encounter Rate
BIP	Bridging Implementation Plan
BOP	Blowout preventer
BP	Boiling Point
BRUV	Baited Remote Underwater Video
C&R	Containment and Recovery
CA	Control Agency / Controlling Authority
CASA	Civil Aviation Safety Authority
CCR	Central Control Room
CEO	Chief Executive Officer
CHARM	Chemical Hazard Assessment and Risk Management
CM	Crisis Management
CMST	Crisis Management Support Teams
CMT	Crisis Management Team
CR	Conservation Reserve
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSR	Company Site Representative
CTD	Conductivity Temperature Depth (meter)
D&C	Drilling and Completions
DBCA	Department of Biodiversity, Conservation and Attractions (WA)
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DCMP	Drilling and Completions Management Process
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety (WA)
DEPWS	Department of Environment, Parks and Water Security (NT)
DEW	Department of Environment and Water (SA)
DFAT	Department of Foreign Affairs and Trade (Commonwealth)
DISR	Department of Industry, Science and Resources (Commonwealth)
DLNG	Darwin Liquefied Natural Gas

Abbreviation	Definition
DoT	Department of Transport (WA)
DPIF	Department of Primary Industry and Fisheries (NT)
DPIRD	Department of Primary Industries and Regional Development (WA)
DWER	Department of Water and Environment Regulation (WA)
EC_{50}	Half-maximal Effective Concentration
EHS	Environmental, Health and Safety
EMBA	Environment That May Be Affected
EMSA	European Maritime Safety Agency
EP	Environment Plan
EPA	Environment Protection Authority (NT)
EPS	Environmental Performance Standard
ER	Emergency Response
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESC	Environmental Scientific Coordinator
ESD	Emergency Shutdown Device
FOB	Forward Operating Base
FPSO	Floating Production, Storage and Offloading (*BW Opal*)
FSO	Floating Storage and Offloading
FWAD	Fixed-wing Aerial Dispersant
FWADC	Fixed-wing Aerial Dispersant Capability
g/m^2	Grams per square metre
GAPA	Government and Public Affairs
GDS	Global Dispersant Stockpile
GEP	Gas Export Pipeline
GIS	Geographic Information System
GOWRS	Global Oiled Wildlife Response Service
GPS	Global Positioning System
Ha	Hectare
HDPE	High-density polyethylene
HEV	High Environmental Value
HFO	Heavy Fuel Oil
HMA	Hazard Management Agency
HQ	Headquarters
HR	Human Resources
HSE	Health, Safety and Environment
IAP	Incident Action Plan
IBC	Intermediate Bulk Container
ICC	Santos Incident Coordination Centre
ICS	Incident Command System
ID	Identity; identification
IFO	Intermediate Fuel Oil
IMO	International Maritime Organisation

Abbreviation	Definition
IMMR	Inspection, Maintenance, Monitoring and Repair
IMR	Inspection, Maintenance and Repair
IMT	Incident Management Team
IOPG	International Association of Oil and Gas Producers
IPIECA	International Petroleum Industry Environmental Conservation Association
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
IWCF	International Well Control Forum
kL	Kilolitre
km	Kilometre
KPI	Key Performance Indicator
KSAT	Kongsberg Satellite Services
L	Litre
LAT	Lowest Astronomical Tide
LC_{50}	Half-maximal Lethal Concentration
LMRP	Lower Marine Riser Package
m	Metre
m^2	Square metre
m^3	Cubic metre
MARPOL	International Convention for the Prevention of Pollution from Ships
MCT	Monitoring Coordination Team
MDA	MacDonald, Dettwiler and Associates Ltd.
MDO	Marine Diesel Oil
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response
mg/L	Milligrams per litre
MGB	Mobile Garbage Bin
MGO	Marine Gas Oil
mm	Millimetre
MNES	Matters of National Environmental Significance
MODU	Mobile Offshore Drilling Unit
MOP	Marine Oil Pollution
MoU	Memorandum of Understanding
MSA	Master Services Agreement
N/A	Not Applicable
NA	Northern Australia
NC	No Contact
NEBA	Net Environmental Benefit Analysis
nm	Nautical mile
NOAA	National Oceanic Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NP	National Park

Abbreviation	Definition
NSW	New South Wales
NT	Northern Territory
NT IC	Northern Territory Incident Controller
NT IMT	Northern Territory Incident Management Team
NTOSCP	Northern Territory Oil Spill Contingency Plan
NTOWRP	Northern Territory Oiled Wildlife Response Plan
NW	North-West Western Australia
NWS	North West Shelf
OCNS	Offshore Chemical Notification Scheme
OIM	Offshore Installation Manager
OIW	Oil In Water
OMP	Operational Monitoring Plan
OPEP	Oil Pollution Emergency Plan
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSC	On-Scene Commander
OSCA	Oil Spill Control Agents
OSCP	Oil Spill Contingency Plan
OSM	Operational and Scientific Monitoring
OSM-BIP	Operational and Scientific Monitoring- Bridging Implementation Plan
OSR	Oil Spill Response
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organisation
OST	Oil Spill Trajectory
OSTM	Oil Spill Trajectory Modelling
OWA	Oiled Wildlife Advisor
OWR	Oiled Wildlife Response
PINP	Phillip Island National Park
PLET	Pipeline End Terminal
PO	Purchase Order
POLREP	Marine Pollution Report
POWBONS	*Pollution of Waters by Oils and Noxious Substances Act 1987* (WA)
PPA	Priority Protection Areas
ppb	Parts per billion
PPE	Personal Protective Equipment
ppm	Parts per million
PWC	Parks and Wildlife Commission of the Northern Territory
RA	Risk Assessment
RCC	Rescue Coordination Centre (AMSA)
ROV	Remotely Operated Vehicle
SA	South Australia
SAR	Search and Rescue
SCAT	Shoreline Clean-up Assessment Technique
SCP	Source Control Plan

Abbreviation	Definition
SCRI	Source Control Response Industry
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SIMA	Spill Impact Mitigation Assessment
SITREP	Situation Report
SLA	Service Level Agreement
SM	Scientific Monitoring
SMART	Special Monitoring of Applied Response Technologies
SME	Subject Matter Expert
SMP	Scientific Monitoring Plans
SMPA	Scientific Monitoring Priority Area
SMPC	State Marine Pollution Coordinator
SMPEP	Shipboard Marine Pollution Emergency Plan
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plans
SPE	Society of Petroleum Engineers
SRP	Shoreline Response Program
SRT	State Response Team
SSDI	Subsea Dispersant Injection
STR	Shoreline Treatment Recommendations
TEMC	Territory Emergency Management Council (NT)
TEP	Territory Emergency Plan (NT)
TMPC	Territory Marine Pollution Coordinator (NT)
TRG	The Response Group
TRP	Tactical Response Plan
UAV	Unmanned Aerial Vehicle
UK	United Kingdom
US	United States
UXO	Unexploded Ordnance
VI	Varanus Island
VOC	Volatile Organic Compound
VOO	Vessels Of Opportunity
VPO	Vice President Offshore Upstream WA/NA
WA	Western Australia
WAMOPRA	Western Australia Marine Oil Pollution Risk Assessment
WAOWRP	Western Australian Oiled Wildlife Response Plan
WOMP	Well Operation Management Plan
WSP	Waste Service Provider
WWCI	Wild Well Control Inc.

1. Quick Reference Information

If an incident occurs that puts the safety of personnel at significant risk, tasks included in this OPEP may not be implemented, and the International Convention for the Safety of Life at Sea (SOLAS) 1974 may take precedence.

<table>
<tr><th>Parameter</th><th colspan="2">Description</th><th>Further information</th></tr>
<tr><td>Petroleum Activity</td><td colspan="2">Barossa production operations, including operation of a facility and pipeline. Activities within the operational area include:
• Hook-up and integrated commissioning
• Floating Production, Storage and Offloading (FPSO) facility (BW Opal) operations
• Subsea facilities and gas export pipeline operations
• Support and project vessel activities
• Subsea and seabed inspection, maintenance, monitoring and repair (IMMR)</td><td>Section 2: Environment Plan (EP)</td></tr>
<tr><td>Location</td><td colspan="2">Bonaparte Basin in Commonwealth waters ~285 km north-north-west of Darwin[1].
Location of key in-field subsea infrastructure:
• Production turret
– Latitude: 9° 49′ 17.069″ S
– Longitude: 130° 16′ 09.130″ E
• Riser Base Manifold
– Latitude: 9° 49′ 17.181″ S
– Longitude: 130° 15′ 49.437″ E
• Manifold (N1)
– Latitude: 09° 47′ 51.390″ S
– Longitude: 130° 12′ 27.330″ E
• Manifold (S1)
– Latitude: 09° 52′ 07.378″ S
– Longitude: 130° 13′ 43.698″ E
• Manifold (S2)
– Latitude: 09° 52′ 06.196″ S
– Longitude: 130° 18′ 06.476″ E</td><td>Sections 2.3 and 2.4: EP</td></tr>
<tr><td>Petroleum title/s (Blocks)</td><td colspan="2">NT/L1 (production licence), NT/PL5 (pipeline licence)</td><td>N/A</td></tr>
<tr><td>Water depth</td><td colspan="2">220 to 280 m in the Barossa Field
36 to 254 m along the Gas Export Pipeline (GEP)</td><td>Section 3.3.8: EP</td></tr>
<tr><td rowspan="4">Worst-case spill scenarios</td><td>Hydrocarbon (scenario)</td><td>Worst-case volume (duration)</td><td rowspan="4">Section 6.1</td></tr>
<tr><td>Barossa Condensate (Surface release of condensate from the FPSO or offtake tanker as a result of an external impact (vessel collision), which ruptures a condensate storage tank)</td><td>16,700 m^3 (1 hour)</td></tr>
<tr><td>Barossa Condensate (Surface release of MGO from the FPSO as a result of external impact (vessel collision), which ruptures an FPSO MGO tank)</td><td>2,418 m^3 (1 hour)</td></tr>
<tr><td>MDO (Surface release of MDO from a vessel as a result of an external impact (vessel collision), which ruptures an MDO tank)</td><td>500 m^3 (1 hour)</td></tr>
</table>

[1] *Coordinate System: Geocentric Datum of Australia 1994 (GDA94)*

<table>
<tr><th>Parameter</th><th colspan="3">Description</th><th>Further information</th></tr>
<tr><td></td><td colspan="2">HFO (Surface release of HFO from the offtake tanker as a result of external impact (vessel collision), which ruptures an HFO tank on the offtake tanker)</td><td>460 m^3 (1 hour)</td><td></td></tr>
<tr><td rowspan="3">Hydrocarbon properties</td><td colspan="3">Barossa Condensate:
• Density at 16 °C = 782 kg/m^3
• Dynamic viscosity = 1.35 cP @ 10 °C
• API = 50.6
• Pour point = −6 °C
• Volatile components = 93%
• Oil property classification = Non-persistent (Group 1)</td><td rowspan="3">Appendix A</td></tr>
<tr><td colspan="3">MDO:
• Density at 25 °C = 829 kg/m^3
• Dynamic viscosity = 4 cP @ 25 °C
• API = 37.6
• Pour point = −14 °C
• Volatile components = 95%
• Oil property classification = Light persistent (Group 2)</td></tr>
<tr><td colspan="3">HFO
• Density at 25 °C = 974.9 kg/m^3
• Dynamic viscosity = 3,180 cP @ 25 °C
• API = 12.3
• Pour point = 7 C
• Persistent components = 82.8%
• Oil property classification = Persistent heavy (Group 4)</td></tr>
<tr><td>Weathering potential</td><td>Barossa Condensate is a low viscosity, non-persistent hydrocarbon that, if spilt on the sea surface, would rapidly spread and thin out resulting in a large surface area available for evaporation.
The fate of the condensate will depend greatly on the proportion that reaches the surface after rising through the water column. Hence, discharge conditions will have a strong influence on exposure risks for surrounding resources.</td><td>MDO is a mixture of volatile and persistent hydrocarbons with low viscosity. It will spread quickly and thin out to low thickness levels, thereby increasing the evaporation rate. Up to 40% will generally evaporate during the first 24 hours.
Approximately 5% is considered ‘persistent’, which is unlikely to evaporate, though it will decay slowly over time.</td><td>HFO is characterised by a very high density, high viscosity and relatively high pour point. It comprises a high percentage of residual components (83%) that will not evaporate.
The residual component is expected to become semi-solid to solid at ambient temperatures and is susceptible to decay over time. Solid residues can persist in the marine environment for extended periods. HFO does not tend to form stable emulsions.</td><td>Appendix A</td></tr>
<tr><td>Protection priority areas</td><td colspan="3">Tiwi Islands
Beagle Gulf – Darwin Coast
Cape Hotham
Joseph Bonaparte Gulf – East Coast
Vernon Islands Conservation Reserve (CR)
Indonesia East and Timor-Leste
Minor Indonesian islands</td><td>Section 6.6</td></tr>
</table>

2. First-strike response actions

The initial response actions to major incidents at the Barossa FPSO are outlined within the BW Opal Emergency Response Plan (ERP) (BAF-213 6896) and are under the direction of the Emergency Commander. The BW Opal ERP includes site- and role-specific information relevant to the initial stages of an incident response including raising the alarm, mustering personnel, emergency shut-down (ESD) of facility infrastructure, and medical evacuation. The BW Opal ERP nominates the Emergency Commander as the FPSO *BW Opal* Offshore Installation Manager (OIM).

For spills from support vessels and offtake tankers, initial response actions to major incidents are under the direction of the Vessel Master and in accordance with vessel-specific procedures (e.g. Shipboard Oil Pollution Plans [SOPEPs]).

Following the initial actions undertaken by the Emergency Commander / Vessel Master to ensure the safety of personnel and to control the source of the spill, the Emergency Commander / Vessel Master will assess the situation based on:

- What caused the spill?
- Is the source under control?
- What type of hydrocarbon has been spilled?
- How much has been spilled?

Response information contained within this Oil Pollution Emergency Plan (OPEP) is concerned primarily with a large-scale (Level 2/3) hydrocarbon spill where the Perth-based Incident Management Team (IMT) is engaged to support and implement response strategies. Level 1 spills are managed through on-site response and the IMT is available to assist with regulatory requirements/notifications and support if required. Therefore, the immediate response actions listed in Table 2-1 are relevant for any spill.

Once sufficient information is known about the spill, the Incident Commander at the IMT will classify the level of the spill. If the spill is classified as a Level 1 spill, then the actions related to Level 2/3 spills do not apply, unless specified by the Incident Commander. The Barossa Oil Spill First Strike Response Plan and the BW Opal Emergency Response Plan (BAF-213 6896) (both available in Santos' Emergency Response [ER] SharePoint site) should be referred to alongside the first-strike activations in Table 2-1.

Table 2-1: First-strike activations

When (indicative)	Activations		Who
	Objective	Action	
All spills			
Immediate	Manage the safety of personnel	Implement site incident response procedures (BW Opal ERP) or vessel-specific procedures, as applicable	Emergency Commander / Vessel Master
Immediate	Control the source using site resources, where possible	Control the source using available on-site resources (installation / facility / vessel) Refer to Source Control Plan in Section 9	Emergency Commander / Vessel Master
30 minutes of incident being identified	Notify Barossa Production Manager/Incident Commander	Verbally communicate to Barossa Production Manager / Incident Commander's duty phone	Emergency Commander / Vessel Master
As soon as practicable	Obtain as much information about the spill as possible	Provide as much information to the IMT (Incident Commander or delegate) as soon as possible	Emergency Commander / Vessel Master
60 minutes of incident being reported	Gain situational awareness and begin on-site spill surveillance	Level 1 spills may only require the use of on-site resources to conduct monitor and evaluate activities (e.g. vessel surveillance). Refer to Monitor and Evaluate Plan in Section 10	Emergency Commander / Vessel Master Incident Commander (Perth-based IMT)
Refer to timeframes in Section 7	Notify regulators and stakeholders within specified timeframes	Activate the External Notifications and Reporting Procedures – Section 7	Initial notifications by Planning Section Chief – Section 7
Level 2/3 spills (in addition to actions above)			
Immediately once notified of spill (to Incident Commander)	Activate IMT, if required	Notify IMT	Barossa Production Manager / Incident Commander
IMT actions (0 to 48 hours)			
Within 90 minutes from IMT call-out	Set up IMT room	Refer to IMT tools and checklists for room and incident log set-up	Incident Commander IMT Data Manager
	Gain situational awareness and set incident objectives, strategies and tasks	Begin reactive incident action planning process Go to Section 8 Review First-strike Activations (this table), and BW Opal ERP	Incident Commander Planning Section Chief
Refer to timeframes in Section 7	Notify regulators and stakeholders as required Notify and mobilise/put on standby external oil spill response organisations and support organisations, as required	Go to Section 7	Initial notifications by Planning Section Chief Oil Spill Response Organisations (Australian Marine Oil Spill Centre [AMOSC] and Oil Spill Response Ltd [OSRL]) activation by designated call-out authorities (Incident Commanders/Duty Managers)

When (indicative)	Activations		Who
	Objective	Action	
Refer to timeframes in Section 10	Implement monitor and evaluate tactics to provide situational awareness to inform IMT decision-making	Vessel surveillance (Section 10.1) Aerial surveillance (Section 10.2) Tracking buoys (Section 10.3) Oil spill trajectory modelling (Section 10.4) Satellite imagery (Section 10.5)	Operations Section Chief Logistics Section Chief / Supply Unit Leader Environment Unit Leader
Activate on Day 1 as applicable to the incident	Implement source control support to stop the release of hydrocarbons into the marine environment. **Degree of IMT support will be scenario-dependent**	Activate the Source Control Plan. Go to Section 9	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
Activate on Day 1 as applicable to the incident Refer to Sections 12 and 13	Reduce potential exposure of shorelines and wildlife to floating oil through mechanical / chemical dispersion	Activate the Mechanical and/or Chemical Dispersion Plan Go to Sections 12 and 13	Operations Section Chief Logistics Section Chief / Supply Unit Leader
Activate on Day 1 as applicable to the incident Refer to Section 18	Assess and monitor effectiveness of response strategies and potential impacts from spill and response	Activate the Santos Northern Australia Operational and Scientific Monitoring Bridging Implementation Plan (OSM-BIP) (7715-650-ERP-0003) Go to Section 18	Environment Unit Leader Logistics Section Chief / Supply Unit Leader Operations Section Chief
Activate on Day 1 as applicable to the incident Refer to Section 11	Implement containment and recovery tactics to reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Activate the Containment and Recovery Plan Go to Section 11	Operations Section Chief Logistics Section Chief / Supply Unit Leader
Day 1	Identify environmental sensitivities at risk and conduct operational Net Environmental Benefit Analysis (NEBA)	Review situational awareness and spill trajectory modelling Review strategic NEBA and begin operational NEBA (Section 6.7)	Environment Unit Leader
Day 1	Develop forward operational base/s to support forward operations	Begin planning for forward operations base as per Forward Operations Plan (Appendix P)	Operations Section Chief Logistics Section Chief / Supply Unit Leader
Day 1	Ensure the health and safety of spill responders	Identify relevant hazards controls and develop hazard register Begin preparing site health and safety management requirements Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	Safety Officer
If/ when initiated Refer to Section 14	Protect identified shoreline protection priorities	Activate the Shoreline Protection and Deflection Plan Go to Section 14	Operations Section Chief Logistics Section Chief / Supply Unit Leader Environment Unit Leader

<table>
<tr><th rowspan="2">When (indicative)</th><th colspan="2">Activations</th><th rowspan="2">Who</th></tr>
<tr><th>Objective</th><th>Action</th></tr>
<tr><td>If/ when initiated
Refer to Section 16</td><td>Prevent or reduce potential impacts to wildlife</td><td>Activate the Oiled Wildlife Response (OWR) Plan
Go to Section 16</td><td>Environment Unit Leader
Operations Section Chief
Logistics Section Chief / Supply Unit Leader</td></tr>
<tr><td>If/ when initiated
Refer to Section 15</td><td>Clean-up oiled shorelines</td><td>Activate Shoreline Clean-Up Plan
Go to Section 15</td><td>Operations Section Chief
Logistics Section Chief / Supply Unit Leader</td></tr>
<tr><td>If/when initiated
Refer to Section 17</td><td>Safely transfer, transport and dispose of waste collected from response activities.</td><td>Activate the Waste Management Plan.
Go to Section 17</td><td>Operations Section Chief
Logistics Section Chief / Supply Unit Leader</td></tr>
<tr><td colspan="4">IMT Actions (48+ hours)</td></tr>
<tr><td>Ongoing</td><td colspan="2">• For ongoing incident management—indicatively 48+ hours—adopt a formal incident action planning process to continue with the spill response strategies identified above. An Incident Action Plan (IAP) is to be developed for each successive operational period.
• Santos will maintain control for those activities for which it is the designated Control Agency/ Lead IMT.
• Depending on the specifics of the spill, the Australian Maritime Safety Authority (AMSA), the Northern Territory (NT) IMT, and/or Western Australia (WA) Department of Transport (DoT) may be relevant Control Agencies (refer to Section 4.2).
• If another Control Agency has taken control of aspects of the response, Santos will provide support to that Control Agency. Santos’ support to the NT IMT (for a spill that impacts the NT shoreline) and the WA DoT (for a WA State waters response) is detailed in Sections 4.6.2 and 4.6.3 respectively.</td><td>Control Agency IMT
For WA State waters response, Santos to provide the following roles to WA DoT Maritime Environmental Emergency Coordination Centre (MEECC) / IMT (refer to Table 5-5) (Note: similar roles may also be provided to support the NT IMT in the event of a response in NT waters, if requested):
• Crisis Management Team (CMT) Liaison Officer
• Deputy Incident Controller
• Deputy Intelligence Officer
• Deputy Planning Officer
• Environment Support Officer
• Deputy Public Information Officer
• Deputy Logistics Officer
• Deputy Waste Management Coordinator
• Deputy Finance Officer
• Deputy Operations Officer
• Deputy Division Commander – Forward Operating Base (FOB)</td></tr>
</table>

3. Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Barossa Production Operations Environment Plan (EP) (BAA-200 0637) required by Regulation 22(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS (E) Regulations).

3.1 Description of activity

Santos Ltd. (Santos) is preparing to conduct operational activities within the Barossa field (production licence NT/L1) and via the associated gas export pipeline (GEP; pipeline licence NT/PL5). The Barossa field is located in Commonwealth waters ~285 km offshore Darwin, NT (Figure 3-1). Water depth in the vicinity of the Barossa field is 220–280 m. The GEP extends from the Barossa field to the existing onshore facilities at the Darwin liquefied natural gas facility (DLNG) (Figure 3-1). Water depths along the Barossa GEP route vary from 254 m at the deepest point at the pipeline end terminal (PLET) A, to 36 m at the shallowest point ~47 km upstream of PLET B.

Activities within the operational areas include:

- hook-up of the FPSO and subsea infrastructure commissioning
- FPSO operations
- subsea infrastructure and GEP operations.
- support and project vessel activities:
  - offshore support vessels providing logistical and inspection, maintenance, and repair (IMR) support
  - offtake tanker for condensate offloading
  - tugs to assist with hook-up and commissioning and offtake tanker positioning
  - accommodation vessel to provide additional bed space during maintenance campaigns
  - subsea and seabed inspection, maintenance, monitoring and repair, which may include using remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs).

Refer to Section 2 of the Barossa Production Operations EP (BAA-200 0637) for a comprehensive description of the activity.

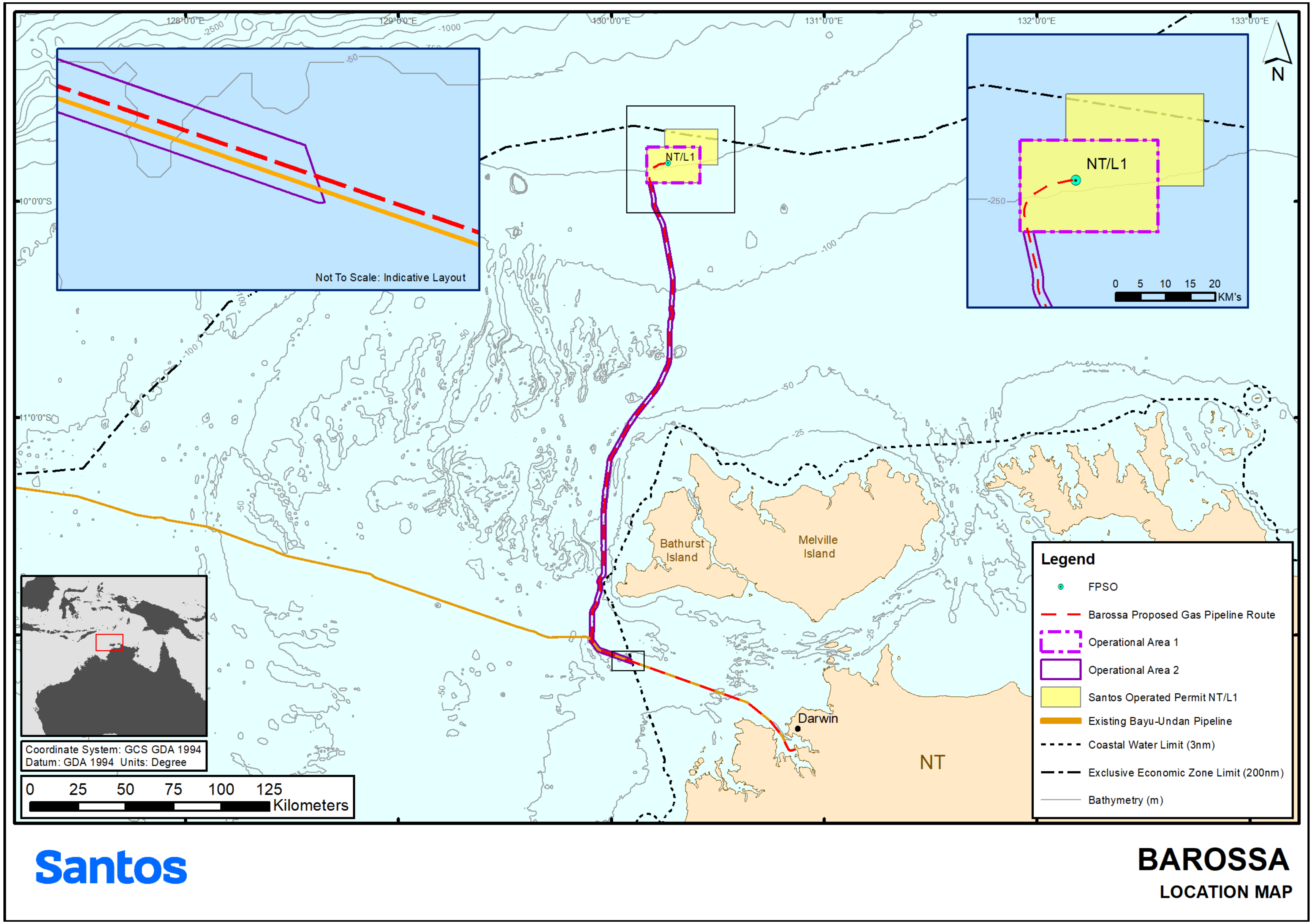

Figure 3-1: Location of the Barossa field, NT/L1 permit area and gas export pipeline

3.2 Purpose

This OPEP describes Santos' response to a hydrocarbon spill during Barossa Production Operations activities.

This OPEP has been developed to meet all relevant requirements of the Commonwealth OPGGS (E) Regulations. It is consistent with the Australian (national), NT and State (WA) systems for oil pollution preparedness and response, which are detailed in these documents:

- National Plan for Maritime Environmental Emergencies (AMSA, 2020) managed by AMSA
- NT Oil Spill Contingency Plan (NT DoT, 2014)
- Territory Emergency Plan (NT Government, 2021)
- WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE) (WA DoT, 2024).

This OPEP is to be read in conjunction with the Barossa Production Operations EP (BAA-200 0637) when considering the existing environment, environmental impacts, risk management, performance standards and the reporting compliance requirements.

This OPEP will apply from acceptance of the Santos Barossa Production Operations EP (BAA-200 0637) and will remain valid for the duration of life of the EP.

The response strategies outlined in this OPEP have been developed by Santos using risk assessments to identify credible worst-case hydrocarbon spill scenarios, expected/calculated release rates, known information of hydrocarbon types and behaviour, and expected partitioning of the hydrocarbon within the marine environment with an estimate of the volume of persistent oil. This information has been modelled to give a theoretical zone of dispersion that is used to identify potential sensitive receptors and response strategies required to reduce the consequences of a spill to 'as low as reasonably practicable' (ALARP). The response strategies are identified under a NEBA process so the most effective response strategies with the lowest environmental consequences can be identified, documented and prepared for.

3.3 Objectives

The aim of this OPEP is to provide detailed guidance to Santos' IMT, so that it will direct its response effort with the aim of preventing long-term significant environmental impacts by safely limiting the adverse environmental effects from an unplanned release of hydrocarbons to the marine environment to a level that is ALARP. This will be achieved by implementing the various strategies and spill response mechanisms presented throughout this OPEP. Through this implementation, Santos will:

- initiate spill response immediately following a spill
- establish source control as soon as reasonably practicable to minimise the amount of oil being spilt into the environment
- assess the spill characteristics and understand its fate so as to make informed and clear response decisions
- monitor the spill to identify the primary marine and coastal resources requiring protection
- remove as much oil as possible from the marine environment while keeping environmental impacts from the removal methods to ALARP
- reduce the impacts of the remaining floating and stranded oil to ALARP
- respond to the spill using efficient response strategies that do not damage the environment
- comply with all relevant environmental legislation when implementing this OPEP
- conduct all responses safely without causing harm to participants
- monitor the impacts from a spill until impacted habitats have returned to baseline conditions
- remain in a state of 'readiness' at all times for implementing this OPEP by keeping resources ready for deployment, staff fully trained and completing response exercises as scheduled
- keep stakeholders informed of the status of the hydrocarbon spill response to help reduce social and economic impacts.

3.4 Area of operation

The proposed Barossa development is located within permit area NT/L1 within Commonwealth (Australian) waters of the Bonaparte Basin.

Operational area 1 (field operational area) lies within Commonwealth waters in the Timor Sea, ~130 km north of the Tiwi Islands and 285 km north-north-west of Darwin.

The GEP extends from the Barossa field to the existing onshore facilities at DLNG (Figure 3-1). The total length of the GEP within Commonwealth waters is 262 km. Operational area 2 encompasses the area 500 m either side of the GEP route downstream of PLET A at the Barossa field to the Commonwealth / NT waters boundary.

Section 3 of the Barossa Production Operations Environment Plan (BAA-200 0637) includes a comprehensive description of the existing environment.

Table 3-1 lists regional features and their distance from the Barossa field.

Table 3-1: Distances from Barossa Field to regional features

Regional feature	Distance from Barossa field
Tiwi Islands	130 km (south)
Oceanic Shoals Marine Park	33.5 km (south-east)
Cartier Island	772 km (distance from the Sanctuary Zone)
Indonesia and Timor-Leste	160 km (north – Selaru Island, Indonesia) 343 km (west – Jaco Island, East Timor)

3.5 Interface with internal documents

In addition to this OPEP, several other Santos documents provide guidance and instruction relevant to spill response, including:

- Barossa Oil Spill First Strike Response Plan
- *BW Opal* Emergency Response Plan (BAF-213 6896)
- Barossa Development Wells Source Control Plan (7720-390-ERP1-0001)
- Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001)
- Emergency Response Bridging Document (inspection, maintenance, monitoring and repair [IMMR] specific scope of work)
- Incident Management Plan – Upstream Offshore (SO-00-ZF-00025)
- Santos Incident Management Handbook
- Santos Crisis Management Plan (SMS-HSS-OS05-PD03)
- Barossa Production Operations EP (BAA-200 0637)
- Barossa BW Offshore Environmental Implementation Plan (BAF-205 0967)
- FPSO *BW Opal* – Barossa Terminal Handbook (BAF-206 4299)
- Incident Response Telephone Directory (SO-00-ZF-00025.020)
- Refuelling and Chemical Management Standard (SO-91-IQ-00098)
- Santos Waste Management Plan – Oil Spill Response Support (BAA-201_0027)
- Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)
- Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)
- Santos Oiled Wildlife Sample Collection Protocol
- Oil Spill Scientific Monitoring Baseline Data Review (SO-91-RF-20022)
- Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)
- Santos Offshore Division Oil Spill Response Readiness Guideline (7710-650-GDE-0001)

- Santos Offshore – Oil and Water Sampling Procedures (7710-650-PRO-0008)
- Santos Marine Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
- Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017).
- Santos Northern Australia Operational and Scientific Monitoring – Bridging Implementation Plan (OSM-BIP) (7715-650-ERP-0003).

3.6 Interface with external documents

Information from the following external documents has been used or is referred to in this OPEP:

- AMOSPlan – Australian Industry Cooperative Spill Response Arrangements
  - details the cooperative arrangements for response to oil spills by Australian oil and associated industries.
- Offshore Petroleum Incident Coordination Framework
  - provides overarching guidance on the Australian Government's role and responsibilities in the event of an offshore petroleum incident in Commonwealth waters.
- National Plan for Maritime Environmental Emergencies (National Plan) and National Marine Oil Spill Contingency Plan
  - sets out national arrangements, policies and principles for managing maritime environmental emergencies. The plan provides for a comprehensive response to maritime environmental emergencies regardless of how costs might be attributed or ultimately recovered.
- NT Territory Emergency Plan
  - describes the NT approach to emergency and recovery operations, the governance and coordination arrangements, and roles and responsibilities of agencies (go to https://pfes.nt.gov.au/sites/default/files/uploads/files/2021/NTES_Territory_Emergency_Plan_2021.pdf).
- NT Oil Spill Contingency Plan (NTOSCP)
  - outlines the approach to managing marine oil pollution that is the responsibility of the NT Government.
- WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE)
  - details the management arrangements for preparing for and responding to a marine pollution incident occurring in State waters.
- WA DoT Incident Management Plan – Marine Oil Pollution
  - provides the WA DoT, as the hazard management agency (HMA) for marine oil pollution (MOP), with an incident management plan that outlines the procedures and arrangements for responding to MOP incidents occurring within or impacting WA State waters
  - WA DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (go to: DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements).
- Joint Industry Operational and Scientific Monitoring Framework
  - provides a standardised approach to oil pollution monitoring, including industry guidance, templates, worked examples and standardised operational and scientific monitoring (OSM) plans that titleholders can apply to identify and detail monitoring arrangements and capabilities in their EP and OPEP submissions.
- NT Oiled Wildlife Response Plan (NTOWRP)
  - AMOSC (on behalf of AMOSC Titleholder Members ConocoPhillips, INPEX and Shell Australia) developed the NTOWRP, which provides useful information relating to wildlife priority response areas in the NT based on the NT's prescribed Sites of Conservation Significance.
- WA Oiled Wildlife Response Plan (WAOWRP)
  - establishes the framework for responding to potential or actual wildlife impacts in WA State waters, within the framework of an overall maritime environmental emergency
  - outlines risk reduction strategies, preparedness for, response to and initiation of recovery arrangements for wildlife impacts during a marine oil pollution incident.

- WA Oiled Wildlife Response Manual
  - a companion document to the WAOWRP for maritime environmental emergencies, designed to standardise operating procedures, protocols and processes for wildlife response.
- Shipboard Oil Pollution Emergency Plans (SOPEP)
  - under International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I requirements, all vessels of over 400 gross tonnage must have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill, including steps taken to contain the source with equipment available onboard the vessel.
- OSRL Associate Agreement
  - defines the activation and mobilisation methods of OSRL spill response personnel and equipment allocated under contract.
- Australian Government Coordination Arrangements for Maritime Environmental Emergencies:
  - provides a framework for coordinating Australian Government departments and agencies in response to maritime environmental emergencies.

3.7 Document review

In line with regulatory requirements, this OPEP shall be reviewed, updated and submitted to the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA) every 5 years from date of acceptance.

This OPEP may be reviewed and revised more frequently, if required, in accordance with the Santos Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to one or more of the following:

- when major changes have occurred that affect oil spill response coordination or capabilities
- changes to the Environment Plan (EP) that affect oil spill response coordination or capabilities (e.g. a significant increase in spill risk)
- following routine testing of the OPEP if improvements or corrections are identified
- after a Level 2/3 spill incident.

The extent of changes made to the OPEP and resultant requirements for regulatory resubmission will be informed by the relevant Commonwealth regulations; i.e. the OPGGS (E) Regulations.

The custodian of this OPEP is the Santos Lead Oil Spill Risk & Planning Coordinator.

4. Spill management arrangements

4.1 Response levels and escalation criteria

Santos uses a tiered system of 3 incident response levels consistent with the National Plan (AMSA, 2020) and the WA SHP-MEE (WA DoT, 2024). Spill response levels help identify the severity of an oil spill incident and the level of response required to manage the incident and mitigate environmental impacts. Incident response levels are outlined in the Santos Incident Management Plan – Upstream Offshore (SO-00-ZF-00025) and further detailed in Table 4-1 for hydrocarbon spills.

Table 4-1: Santos oil spill response levels

Level 1	
An incident that will not have an adverse effect on the public or the environment, which can be controlled by using resources normally available on site without the need to mobilise the Santos IMT or other external assistance.	
• Oil is contained within the incident site. • Spill occurs within immediate site proximity. • Incident can be managed by the On-site Emergency Response Team (ERT) and its resources.	• Source of spill has been contained. • Oil is evaporating quickly and no danger of explosive vapours. • Spill likely to naturally dissipate. • No media interest/no adverse effect on the public.
Level 2	
An incident that cannot be controlled by the use of on-site resources alone and requires external support and resources to combat the situation; or An incident that can be controlled on site, but which may have an adverse effect on the public or the environment.	
• Danger of fire or explosion. • Possible continuous release. • Concentrated oil accumulating close to the site or vessel. • Potential to impact other installations.	• Level 1 resources overwhelmed, requiring additional regional resources. • Potential impact to sensitive areas and/or local communities. • Local/national media attention/may adversely affect the public or the environment.
Level 3	
An incident that has a wide-ranging impact on Santos and may require the mobilisation of external state, national or international resources to bring the situation under control.	
• Loss of well integrity. • Actual or potentially serious threat to life, property, industry. • Major spill beyond site vicinity. • Significant shoreline environmental impact.	• Level 2 resources overwhelmed, requiring international assistance. • Level 3 resources to be mobilised. • Significant impact on local communities. • International media attention.

4.2 Jurisdictional authorities and Control Agencies

The responsibility for an oil spill depends on the spill's location and its origin. The National Plan (AMSA, 2020) sets out the divisions of responsibility for an oil spill response. Definitions of Control Agency and Jurisdictional Authority are:

- **Control Agency**[2]**:** the organisation assigned by legislation, administrative arrangements or within the relevant contingency plan, to control response activities to a maritime environmental emergency. Control Agencies have the operational responsibility of response activities but may have arrangements in place with other parties to provide response assistance under their direction.
- **Jurisdictional Authority:** the agency responsible for verifying that an adequate spill response plan is prepared and, in the event of an incident, that a satisfactory response is implemented. The Jurisdictional Authority is also responsible for initiating prosecutions and the recovery of clean-up costs on behalf of all participating agencies.

[2] *Also known as the 'Controlling Authority' in the NT context as per the Northern Territory Emergency Plan (2021).*

Table 4-2 provides guidance on the designated Control Agency and Jurisdictional Authority for Commonwealth and State/Territory waters and for vessel and petroleum activity spills.

To help determine a vessel versus a petroleum activity spill, the following guidance is adopted:

- In Commonwealth waters, a vessel is a ship at sea to which the Commonwealth *Navigation Act 2012* applies. This is defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA, 2017a) as a seismic vessel, supply or support vessel, or offtake tanker.
- A petroleum activity includes facilities such as a fixed platform, FPSO/FSO, mobile offshore drilling unit (MODU), subsea infrastructure, or a construction, decommissioning and pipelaying vessel, as defined by Schedule 3, Part 1, Clause 4 and Volume 2, Part 6.8, Section 640 of the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act).

Table 4-2: Jurisdictional Authorities and Control Agencies for hydrocarbon spills

Jurisdictional boundary	Spill source	Jurisdictional Authority	Control Agency		Relevant documentation
			Level 1	Level 2/3	
Commonwealth waters (3–200 nautical miles from Territory/state sea baseline)	Vessel[3]	AMSA	AMSA		Vessel SOPEP National Plan Barossa Production Operations OPEP (this document)
	Petroleum activities[4]	NOPSEMA	Titleholder		Barossa Production Operations OPEP (this document)
NT waters (Territory waters to 3 nautical miles and some areas around offshore atolls and islands)	Vessel	NT Department of Environment, Parks and Water Security (DEPWS)	Vessel owner	DEPWS / NT Incident Controller (IC) / Territory Emergency Management Council (TEMC)[5]	Vessel SOPEP Barossa Production Operations OPEP (this document) Relevant NTOSCP
	Petroleum activities	NT DEPWS	Titleholder		Barossa Production Operations OPEP (this document) Relevant NTOSCP
WA waters (State waters to 3 nautical miles and some areas around offshore atolls and islands)	Vessel	WA DoT	WA DoT	WA DoT	Vessel SOPEP State Hazard Plan: Maritime Environmental Emergencies (WA DoT, 2024) WA Incident Management Plan – Marine Oil Pollution (WA DoT, 2023) Barossa Production Operations OPEP (this document)
	Petroleum activities	WA DoT	Titleholder	WA DoT	Barossa Production Operations OPEP (this document) State Hazard Plan: Maritime Environmental Emergencies (WA DoT, 2024)
International waters[6]	All activities	Relevant foreign authority	Santos will liaise with the Australian Government Department of Foreign Affairs and Trade (DFAT) if an oil spill enters international waters. Santos will work with DFAT and the respective governments to support response operations.		

[3] Vessels are defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA, 2017a) as a seismic vessel, supply or support vessel. Note: This definition does not apply to WA State waters.

[4] Includes a 'facility', such as a fixed platform, FPSO/FSO, MODU, subsea infrastructure, or a construction, decommissioning and pipelaying vessel. As defined by Schedule 3, Part 1, Clause 4 of the OPGGS Act 2006.

[5] Combination of DEPWS / TEMC / NT Police may assume the 'Control Agency / Controlling Authority' (CA) role if DEPWS is unable to manage as the CA.

[6] AMSA (2017b) Coordination of International Incidents: Notification Arrangements Guidance. Guidance NP-GUI-007.

4.3 Petroleum activity spill in Commonwealth waters

For an offshore petroleum activity spill in Commonwealth waters, the Jurisdictional Authority is NOPSEMA, which is responsible for overseeing response actions to pollution events from offshore petroleum activities in areas under Commonwealth jurisdiction. During a spill incident, NOPSEMA's role will be to implement regulatory processes to monitor and secure compliance with the OPGGS Act 2006 and OPGGS (E) Regulations, including issuing directions as required, and investigating accidents, occurrences and circumstances involving deficiencies in environment management.

Under the OPGGS (E) Regulations and the OPGGS Act 2006, the Petroleum Titleholder (i.e. Santos) is responsible for responding to an oil spill incident as the Control Agency in Commonwealth waters, in accordance with its OPEP.

4.4 Vessel spills

AMSA manages the National Plan for Maritime Environmental Emergencies (AMSA, 2020) and is the Control Agency for all vessel-based spills in areas under Commonwealth jurisdiction. AMSA works with state and territory governments, emergency services and private industry to maximise Australia's marine pollution response capability. For all Level 2/3 vessel-based spills in NT waters the DEPWS would assume the Control Agency role. This includes vessels undertaking seismic surveys and associated supply or support vessels.

WA DoT manages the SHP-MEE (WA DoT, 2024) and is the Control Agency for all vessel-based spills in WA State waters outside a port proclaimed under the *Port Authorities Act 1999* (WA). For vessel-based spills within a port proclaimed under this Act, the relevant port authority or WA DoT may be the Control Agency.

If a vessel-based spill were to occur in NT waters, the relevant NT Control Agency would respond accordingly.

In all circumstances, the Vessel Master is responsible for implementing source control arrangements detailed in the vessel-specific SOPEP.

Once initial notifications to the Control Agency are made, Santos shall maintain direct contact with the Control Agency and act as a supporting agency throughout the response. This includes providing essential services, personnel, materials or advice to support the Control Agency. In addition, Santos will be required to implement monitoring activities as outlined in the Monitor and Evaluate Plan (Section 10) and Operational and Scientific Monitoring (Section 18).

4.5 Cross-jurisdictional spills

Note: Oil spill modelling did not predict contact to or within WA jurisdictional boundaries. The following information on WA arrangements is included in this OPEP on a precautionary basis due to the proximity of low-threshold exposure areas to WA jurisdictional boundaries; however, it is unlikely that a spill will cross from Commonwealth to WA jurisdictions, and therefore unlikely that WA DoT arrangements will be implemented.

4.5.1 Cross-jurisdictional petroleum activity spills

If a Level 2/3 petroleum activity spill crosses jurisdictions between Commonwealth and Territory/State waters, the Jurisdictional Authority remains true to the source of the spill (i.e. NOPSEMA for Commonwealth waters, NT Control Agency for Territory waters, and WA DoT for State waters).

If a Level 2/3 spill originating in Commonwealth waters moves into Territory/State waters multiple Control Agencies will exist: NT Control Agency / WA DoT and the Petroleum Titleholder (Santos), each with its own IMT and Lead IMT responsibilities. The arrangements between NT Control Agency / WA DoT and Santos for sharing resources and coordinating a response across both Commonwealth and State waters are further detailed in Section 4.6.

4.5.2 Cross-jurisdictional vessel spills

If a Level 2/3 vessel spill crosses jurisdictions between Commonwealth and Territory/State waters, multiple Jurisdictional Authorities will exist: AMSA for Commonwealth waters, NT Control Agency for Territory waters, and DoT for WA State waters. Coordination of Control Agency responsibilities will be determined by NT Control Agency, WA DoT and AMSA based on incident specifics, with Santos providing first-strike response and all necessary resources (including personnel and equipment) as a supporting agency, as detailed in Section 4.6.

AMSA may request that WA DoT manage a vessel incident in Commonwealth waters (WA DoT, 2024).

4.6 Integration with government organisations

4.6.1 Australian Maritime Safety Authority

Although NT Control Agency / WA DoT and Santos would be Control Agencies initially for any spill in Territory / State waters (as outlined in Section 4.2), AMSA is the designated Control Agency for vessel spills in Commonwealth waters. Therefore, if a vessel spill enters Commonwealth waters, AMSA may also become a (or the) Control Agency for the response in Commonwealth waters. Arrangements for coordinating and potentially transferring Control Agency status are outlined in AMSA Guidance Note NP-GUI-023: Coordination of Cross-Border Incidents (AMSA, 2017c).

AMSA is to be notified immediately of all ship-source incidents through the AMSA Rescue Coordination Centre (RCC) (Santos Incident Response Telephone Directory [SO-00-ZF-00025.020]).

AMSA manages the National Plan, Australia's key maritime emergency contingency and response plan (AMSA, 2020). AMSA fulfils its obligations under the National Plan for non–ship-source pollution incidents on the formal request from the respective Offshore Petroleum Incident Controller/s (AMSA, 2021a). AMSA also has a range of National Plan supporting documents containing related policies, guidance and advisory information.

For any oil pollution event, Santos agrees to notify AMSA immediately in the interests of facilitating the most efficient and effective response to the incident.

4.6.2 Northern Territory

For a spill originating from a Santos activity, as soon as possible and within 24 hours of Santos becoming aware of an incident/spill that could reach NT coastal waters or shorelines, Santos will notify the NT Pollution Response Hotline and the DEPWS, in their role as HMA for oil spills in NT waters (excluding spills originating within Darwin Harbour[7]) under the 'all-hazards' Territory Emergency Plan (TEP) (NT Emergency Services, 2022)[8].

Upon notification of a spill entering NT waters, or with the potential to enter NT waters, the DEPWS, as the Control Agency[9], specifically, the DEPWS Chief Executive Officer (CEO) in their role as the Territory Marine Pollution Coordinator (TMPC), will notify the Territory Emergency Controller (NT Commissioner of Police or delegate) who will appoint an NT Incident Controller (NT IC). The NT IC will form an NT IMT appropriate to the scale of the incident with representatives from relevant emergency 'Functional Groups' as identified under the TEP. If required an IMT will be established, comprising staff from across NT Government. If requested by the NT IC, members from the National Response Team may also be present. The NT IMT will be supported by existing NT emergency response arrangements, as defined in the NT *Emergency Management Act 2013*, through the TEMC and the TEP.

The Northern Territory Oil Spill Contingency Plan (NTOSCP; Northern Territory Government, 2021) is a sub-plan under the TEP. DEPWS has agreed, through consultation with the NT Government and the Australian Energy Producers (AEP) (formerly Australian Petroleum Production & Exploration Association [APPEA]) Oil Spill Preparedness and Response Working Group (20 June 2023), in principle, to use the WA DoT Marine Oil Pollution: Response and Consultation Arrangements (WA DoT, 2020), as the basis for developing NT cross-jurisdictional arrangements. A working group is being established to develop the NT cross-jurisdictional arrangements, which once agreed, will be updated into the NTOSCP. In the interim, the WA DoT (2020) cross-jurisdictional guidance can be broadly used by titleholders, as reference for how to support the NT IMT. Figure 4-1 shows the coordination structure between Santos and the NT Government for Barossa offshore petroleum incidents.

For all Level 2/3 spills from vessel/petroleum activities that enter NT waters, the DEPWS will assume the role of Control Agency.

The NT IC, with advice from NT environment, scientific and technical advisors, will work with the Santos IMT to agree protection priorities and determine the most appropriate response in NT waters. Santos will provide support to the NT IMT from the Santos IMT at the Incident Coordination Centre (ICC) in Perth. The Santos IMT will provide support, including drafting operational tasks or IAPs, to the NT IC for approval before their release/implementation.

At the request of the NT IC, Santos will be required to provide all necessary resources, including personnel and equipment, to assist the NT IMT in performing its duties for NT waters and shorelines, including providing personnel to:

- work within the NT IMT

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[7] Darwin Port is the Control Agency for oil spills within Darwin Harbour, including all shipping spills, and Level 2 and above facility spills.

[8] At the time of writing this document (July 2024) the NT DEPWS is the 'Controlling Authority' and HMA for oil spills in NT waters (excluding Darwin Harbour) under the 'all-hazards' Territory Emergency Plan (TEP) (NT Emergency Services, 2022).

[9] This term is known as the 'Controlling Authority' in the TEP.

- help with response activities such as shoreline protection, clean-up and OWR.

To facilitate coordination between the NT IMT and Santos IMT during a response, the NT IMT and Santos Forward Operating Base (FOB) will be established to ensure objectives align and provide a mechanism for managing conflicting priorities and resourcing requests directly between the Santos IMT in Perth and NT IMT in Darwin.

The NT Government and relevant Control Agency intends using the NTOWRP (AMOSC, 2019) as the basis for determining protection priorities and shoreline response planning.

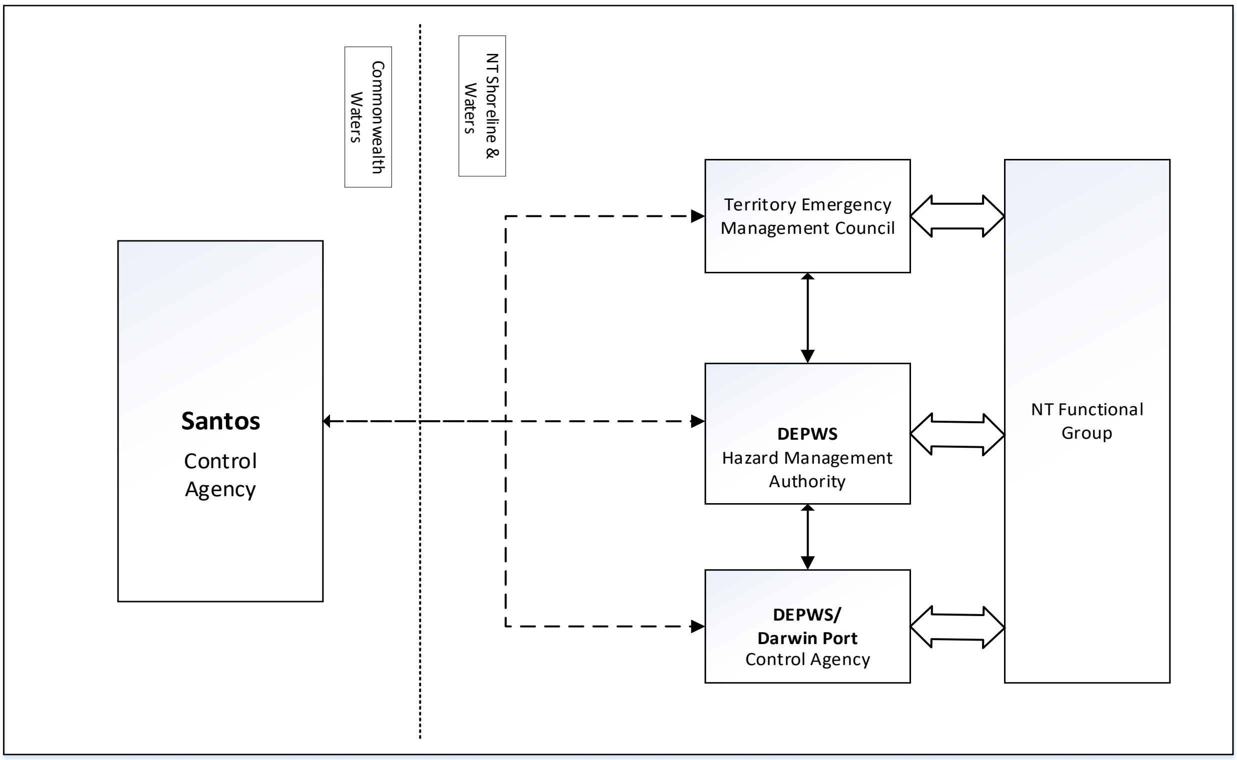

Figure 4-1: Coordination structure between Santos and NT Government for Barossa offshore petroleum incidents

4.6.3 Western Australia

Note: Oil spill modelling did not predict contact within WA jurisdictional boundaries. The following information on WA arrangements is included in this OPEP on a precautionary basis due to the proximity of low-threshold exposure areas to WA jurisdictional boundaries; however, it is unlikely that a spill will cross from Commonwealth to WA jurisdictions, and therefore unlikely that WA DoT arrangements will be implemented.

4.6.3.1 WA Department of Transport

If a Level 2/3 marine oil pollution incident enters WA State waters, the WA DoT is the HMA (WA DoT CEO or proxy). The Director Maritime Environmental Emergency Response (MEER) & Ports has been nominated by the HMA to perform the role of State Marine Pollution Coordinator (SMPC) (as prescribed in Section 1.3 of the SHP–MEE [WA DoT, 2024]). Under the SHP-MEE, the Control Agency for Level 2/3 spills in State waters is WA DoT. During a Maritime Environmental Emergency (MEE) incident within State and Port waters, the role of the SMPC provides strategic management of the incident response on behalf of the HMA.

For Level 2/3 spills entering or within WA State waters/shorelines, WA DoT (as the Control Agency) is the ultimate decision maker regarding identifying and selecting protection priorities. WA DoT will use their internal processes, which typically include:

- evaluate situational awareness information, including all surveillance, monitoring and visualisation data provided by the Titleholder
- evaluate resources at risk including use of the WA Oil Spill Response Atlas and any other relevant WA/Australian government databases or other information sources
- evaluate shoreline types, habitat types and seasonality of environmental, socioeconomic and cultural values and sensitivities
- consult with the State Environmental Scientific Coordinator (ESC) and other relevant State and Australian government departments with environmental responsibilities

- consult with other relevant oil spill agencies, including the AMSA environment, science and technology network or any other experts as necessary
- use all information in a NEBA/Spill Impact Mitigation Analysis (SIMA) type process to determine protection priorities and response strategies.

WA DoT will adjust/amend their internal processes to suit the spill situation at the time.

Santos will notify the WA DoT MEER unit as soon as reasonably practicable (within 2 hours of a spill occurring) if an actual or impending spill occurs within or may impact WA State waters. On notification, the SMPC will activate their Maritime Environmental Emergency Coordination Centre (MEECC) and the WA DoT IMT.

For facility oil spills entering WA State waters (i.e. across jurisdictions), WA DoT will only assume the role of Control Agency for that portion of the response activity that occurs within State waters, and therefore both Santos and WA DoT will be Control Agencies. Titleholders will work in partnership with WA DoT during such instances, as outlined within the WA DoT Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (WA DoT, 2020).

Santos will conduct initial response actions in WA State waters as necessary in accordance with its OPEP and continue to manage those operations until formal handover of incident control in State waters is completed. Appendix 1 in WA DoT's Offshore Petroleum Industry Guidance Note (WA DoT, 2020) provides a checklist for formal handover. Beyond formal handover, Santos will continue to provide all necessary resources, including personnel and equipment, to assist WA DoT in performing its duties as the Control Agency for State waters.

For a cross-jurisdictional response, there will be a Lead IMT (WA DoT or Santos) for each spill response activity, noting that WA DoT only has Jurisdictional/Control Agency authority within State waters.

Appendix 2 in the Offshore Petroleum Industry Guidance Note (WA DoT, 2020) provides guidance on allocating a Lead IMT to response activities for a cross-jurisdictional spill.

To facilitate coordination between WA DoT and Santos during a cross-jurisdictional response, a Joint Strategic Coordination Committee will be established. This committee will be jointly chaired between the SMPC and a nominated senior representative of Santos and will ensure objectives align and provide a mechanism for managing conflicting priorities and resourcing requests.

For a cross-jurisdictional response, Santos will be responsible for ensuring adequate resources are provided to WA DoT as Control Agency - initially 11 personnel to fill roles in the WA DoT IMT or FOB (refer to Section 5.2) and operational personnel to assist with those response strategies where WA DoT is the Lead IMT. Concurrently WA DoT will also provide 2 of their personnel to the Santos IMT as described in Table 5-4. Santos' CMT Liaison Officer and the Deputy Incident Controller are to attend the WA DoT Fremantle Incident Control Centre as soon as possible after the formal request has been made by the SMPC. It is an expectation that the remaining initial cohort will attend the WA DoT Fremantle Incident Control Centre no later than 8am on the day following the request being formally made to Santos by the SMPC. Santos personnel designated to serve in WA DoT's FOB will arrive no later than 24 hours after receipt of the formal request from the SMPC.

Figure 4-2 shows the organisational structure of Santos incident management personnel within Santos IMT and embedded within WA DoT's MEECC/ IMT.

Figure 4-3 shows the overall cross-jurisdictional organisational structure referenced from the SHP-MEE.

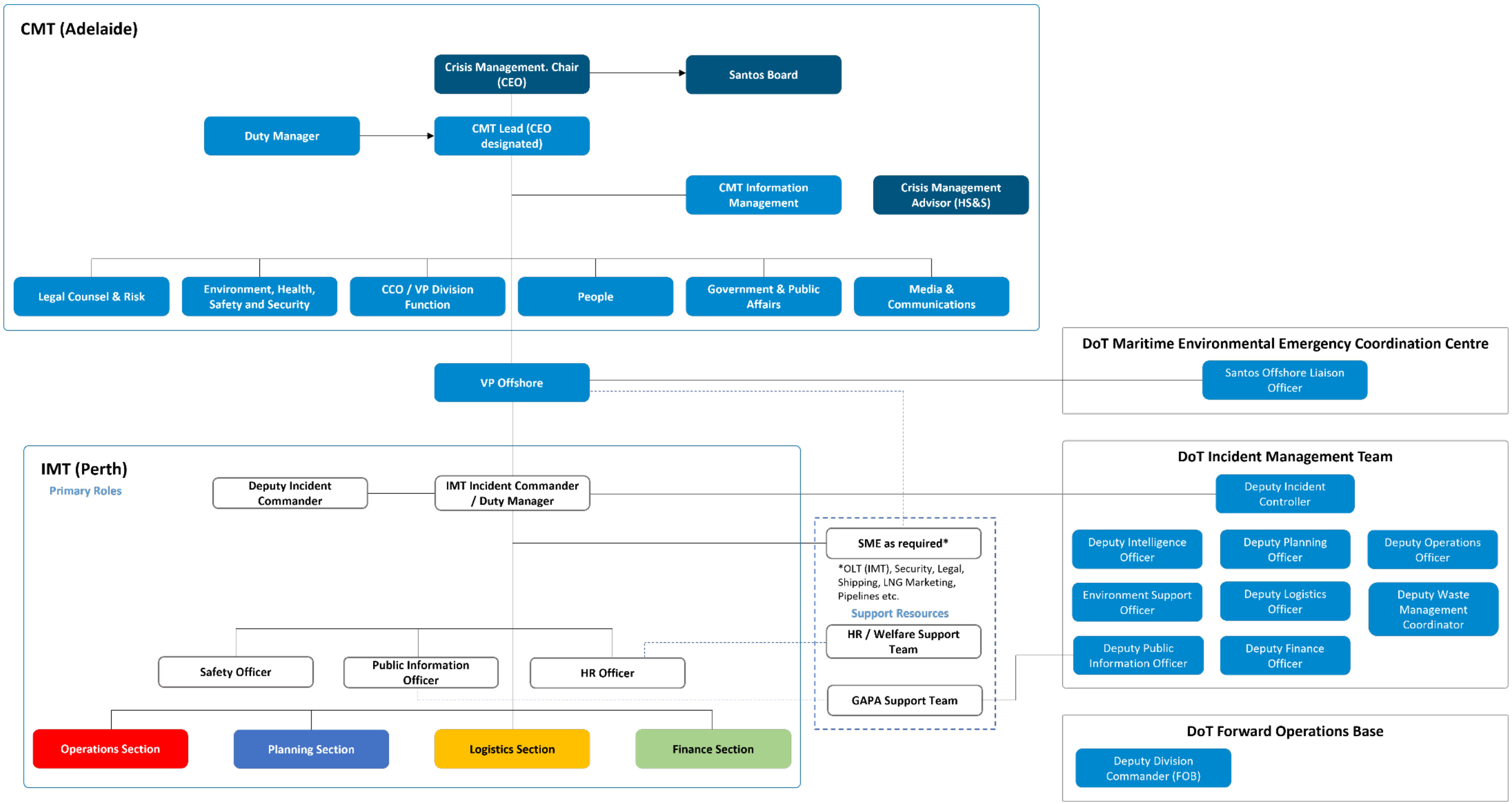

Figure 4-2: Santos cross-jurisdictional incident management structure for Commonwealth waters Level 2/3 facility oil pollution incident entering WA State waters

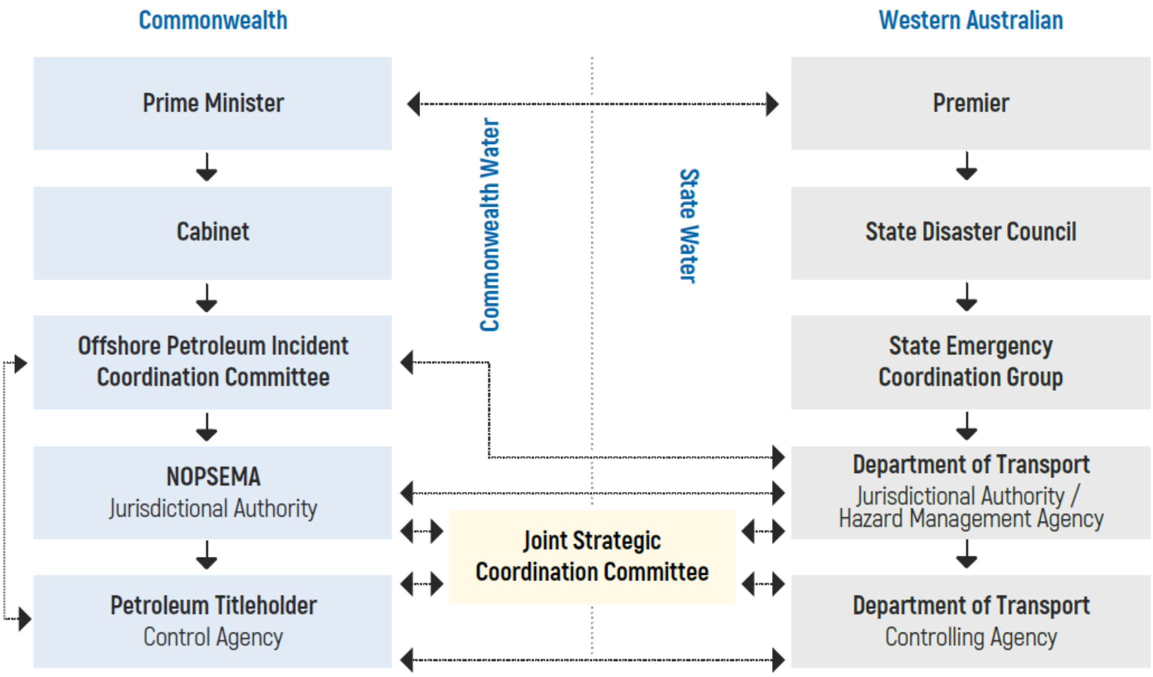

Figure 4-3: Overall control and coordination structure for offshore petroleum cross-jurisdiction incident

4.6.3.2 WA Department of Biodiversity, Conservation and Attractions

The WA Department of Biodiversity, Conservation and Attractions (DBCA) has responsibilities associated with wildlife and activities in national parks, reserves and State marine parks. The *Biodiversity Conservation Act 2016* (WA) is the legislation that provides DBCA with the responsibility and statutory authority to treat, protect, and destroy wildlife. In State waters, DBCA is the Jurisdictional Authority for OWR, providing advice to the Control Agency (WA DoT). The role of DBCA in an OWR is outlined in the WAOWRP (DBCA, 2022a).

For a Level 2/3 petroleum spill that originates within or moves into State waters, WA DoT will be the Control Agency responsible for overall command of an OWR. Santos will provide all necessary resources (equipment and personnel, primarily through AMOSC membership) to WA DoT to facilitate this response.

Any deterrence, displacement or rescue activity involving wildlife in WA (living or dead) constitutes ‘disturbance’ or ‘taking’ of wildlife under the *Biodiversity Conservation Act 2016* and will require authorisation through DBCA unless undertaken by licensed personnel. The DBCA Oiled Wildlife Advisor (OWA) will expedite the process of granting interim licences or other authorities to undertake approved activities. No action specifically targeted at wildlife should occur without this authority. Deceased animal disposal will be managed in accordance with the DBCA’s WAOWRP, which describes the process for disposing of dead animals/carcasses. Initially, the granting of authority to take deceased wildlife is likely to be via a direction from a DBCA wildlife officer while the appropriate licences or licence holder/s that the animals can be held by are identified and organised.

For matters relating to environmental sensitivities and scientific advice in State waters DBCA may provide an Environmental Scientific Coordinator (ESC) to support the SMPC and/or WA DoT Incident Controller.

This may include advice on priorities for environmental protection, appropriateness of proposed response strategies, planning and coordinating operational monitoring for response effectiveness evaluation, and planning scientific monitoring for impact and recovery assessment. The ESC can also advise on where AMSA National Plan Dispersant Effectiveness Test Kits can be located, which could be used in addition to Santos’ dispersant testing resources (refer to Section 13.5.2).

4.6.4 Notification of dispersant use in adjacent Commonwealth waters

Using dispersant in Commonwealth waters does not require the consent of the NT Control Agency or WA DoT. However, where the use of dispersant in Commonwealth waters may impact State waters, the WA DoT requests early notification. The NT Control Agency should also be notified if such use may impact NT waters.

NOPSEMA’s assessment of the OPEP before a petroleum activity commences provides pre-approval for dispersant use, where appropriate, and avoids any delay that might otherwise limit the window of opportunity available for an effective dispersant strategy (NOPSEMA, 2018).

Limitations on surface dispersant application are described further in Section 13.2.1.

4.6.5 Department of Foreign Affairs and Trade

If a spill is predicted to migrate into neighbouring countries' Exclusive Economic Zones, Santos will notify DFAT who will in turn notify the affected government(s) and engage the preferred methods for Santos to respond so as to minimise the impacts to ALARP. In most cases, NOPSEMA, the Commonwealth Department of Industry, Science and Resources (DISR) and DFAT will form an inter-agency panel - the Australian Government Control Crisis Centre - which may request AMSA to coordinate the response operations across the trans-national boundary. Santos remains willing to respond as per the direction of the affected government(s) and designated Control Agency, following approvals established between DFAT and the affected country's government.

4.6.6 Department of Industry, Science and Resources

DISR will be the lead Commonwealth Agency for providing strategic oversight and Australian Government support to a significant offshore petroleum incident (including oil spill incidents). DISR will be notified by NOPSEMA of a significant oil pollution incident and under the Offshore Petroleum Incident Coordination Framework will stand up the Offshore Petroleum Coordination Committee as the mechanism to provide Commonwealth strategic advice and support to the incident. To facilitate information between the Petroleum Titleholder IMT and Offshore Petroleum Incident Coordination Committee, liaison officer/s will be deployed from DISR to the Petroleum Titleholder IMT.

For incidents that are classified at a greater level than Significant (i.e. crisis level), a whole-of-government crisis committee will be formed under the Australian Government Crisis Management Framework to provide strategic advice and support and the Offshore Petroleum Incident Coordination Committee will not be convened, although DISR will remain as the lead agency.

4.7 Interface with external organisations

Santos has contracts in place enabling access to oil spill response organisations (OSROs). OSROs have put specific measures in place to ensure that they are able to continue to meet their commitments to members. This support can be provided directly or remotely to aid the IMT and/or ERT.

4.7.1 Australian Marine Oil Spill Centre

Santos is a participating member of AMOSC and as such has access to AMOSC equipment and personnel as outlined in the AMOSPlan (AMOSC, 2021).

AMOSC has contracts with all its member companies to enable the immediate release of Core Group personnel to be made available for any Santos requirements, as outlined in Santos' Master Service Contract and Principle and Agency Agreement with AMOSC.

The mutual aid arrangements that AMOSC operates under are brought together under the AMOSPlan, and are activated via the AMOSC Duty Officer. This provides the mechanism for members of AMOSC to access oil spill response capability of other members. To further enhance the mutual aid arrangements, Santos, Chevron, Woodside and Jadestone have signed a memorandum of understanding (MoU) that defines the group's mutual aid arrangements. Under this MoU, these companies have agreed to use their reasonable endeavours to help provide emergency response services, personnel, consumables and equipment.

4.7.2 Oil Spill Response Limited

Through an associate membership, Santos has access to spill response services from OSRL with offices in Perth, Singapore, UK and at other various locations around the globe. In the event of a Level 2/3 response, Santos could access OSRL's international personnel, equipment and dispersants to supplement resources available within Australia. Santos may also call on OSRL for technical services to support its IMT.

Under the OSRL associate membership Service Level Agreement (SLA), Santos has access to response personnel (18 per incident) and 50% of the global response equipment stockpile. Santos is also a member of OSRL's Global Dispersant Stockpile (GDS) and OSM Services Supplementary Agreement.

The GDS Supplementary Agreement provides Santos with access to 5,000 m^3 of dispersant stockpile in addition to the dispersant stockpile available under its associate membership SLA. The OSM Services Supplementary Agreement provides Santos with access to OSM services. Additional information on OSM services and capability is provided in the Santos Northern Australia OSM-BIP (7715-650-ERP-0003).

4.7.3 Wild Well Control Inc.

Santos maintains a contract with Wild Well Control Inc. (WWCI) for well control specialist services including relief well drilling. WWCI maintains well control response teams on standby at all times to ensure a rapid response to a well control event anywhere in the world. WWCI maintains an inventory of well control, firefighting, and special services equipment at its Houston headquarters and at other locations in the US and internationally.

4.7.4 The Response Group

The Response Group (TRG) is an international provider of crisis management and emergency response services including oil spill response. TRG are available to Santos 24/7 and can provide personnel for emergency response support.

4.8 Resourcing requirements

The oil spill response resourcing requirements have been considered in this OPEP for each response strategy. To fulfill the required roles, resources have been selected from the various available OSROs and pools of specialist personnel available to Santos within the industry, based on the worst-case response needs that were identified from the oil spill modelling results.

The resourcing requirements focused on specialist roles requiring a minimum level of training and competence (i.e. supervisors / team leaders). In addition, non-skilled personnel required to carry out a response were also considered. These personnel would be resourced from general labour hire, with some requiring a minimum level of induction-type training.

Resourcing requirements were considered cumulatively to ensure adequate availability of specialist response personnel, if all response strategies identified in this OPEP are required simultaneously; Appendix Q presents the cumulative response capability assessment for the Barossa Production Operations activities.

5. Santos incident management arrangements

5.1 Incident management structure

The Santos IMT (Perth) and CMT (Adelaide) will be activated in the event of a Level 2/3 hydrocarbon spill regardless of the type of spill or jurisdiction. Santos maintains internal resources (trained personnel and equipment) across its activities that provide first-strike response capability and support for an ongoing response. If an incident occurs, the IMT Duty Manager would be notified immediately. This rostered role is on call, filled by trained Incident Commanders and available 24 hours/day and 7 days/week. The IMT Duty Manager would then activate the IMT via an automated call-out system. Documentation required in a response is accessed via the Santos Emergency Response (ER) SharePoint site.

As outlined in Section 4, control of the response may be taken over by the relevant Control Agency as the incident progresses. The Santos response structure to a major emergency incident is detailed in the Santos Incident Management Plan – Upstream Offshore (SO-00-ZF-00025) and the Santos Incident Management Handbook. These documents describe response planning and incident management that would operate under emergency conditions and how the Santos IMT operates and interfaces with the CMT and external parties.

The first priority of an escalating oil spill response to a Level 2/3 spill is forming an IMT and establishing an ICC[10]. The ongoing involvement of the IMT and CMT will depend on the severity and type of spill and the obligations of Santos and other agencies/authorities in the coordinated spill response.

Santos' incident response structure relevant to a Barossa Production Operations incident includes:

- Facility-based ERT – manage the incident in accordance with Facility Emergency Response Plan, Third-party Incident Response Plan, and/or activity-specific Oil Spill Contingency Plan or OPEP
- Santos IMT – Perth-based ICC to coordinate and execute responses to an oil spill incident
- CMT – Adelaide-based to coordinate and manage threats to the company's reputation and to handle Santos' corporate requirements in conjunction with the Perth-based Santos – Vice President Offshore Upstream WA / Northern Australia (NA)
- Other field-based command, response and monitoring teams for implementing strategies outlined in the OPEP.

The Santos incident response organisational structure is defined in the Incident Management Plan – Upstream and Offshore (SO-00-ZF-00025), Santos Incident Management Handbook, and is shown in Figure 5-1 for reference. The Santos IMT roles and field-based teams are scalable; roles can be activated and mobilised according to the nature and scale of the incident response.

If the incident involves a well leak, the Santos Source Control Branch would be included in the incident response structure. This team would comprise these sub-teams, according to the applicable source control strategies:

- Relief Well Team
- Well Intervention Team.

The Santos Source Control Branch would report directly to the Operations Section Chief and is responsible for:

- coordinating engineering safety and operational activities
- managing source control technical personnel from third parties (e.g. WWCI)
- developing task-specific plans and procedures
- identifying and sourcing required tools and equipment
- approving source control components of IAPs.

In the event of a Level 2 or 3 spill event, Santos will review the Relevant Persons identification process described in Section 4.2 of the Barossa Production Operations EP (BAA-200 0637). Relevant Persons, whose functions, interests or activities that may be directly affected by the spill event or response arrangements, will be identified and engaged in accordance with the Santos incident management process, noting notification and communications requests made by Relevant Persons during EP consultation with respect to emergency situations.

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[10] *The Santos ICC is located in the Perth office. For protracted responses, transitioning the IMT to Darwin in week 2–3 should be considered. If this decision is made, a group should be formed to prepare for and facilitate the move to minimise disruption to the response effort.*

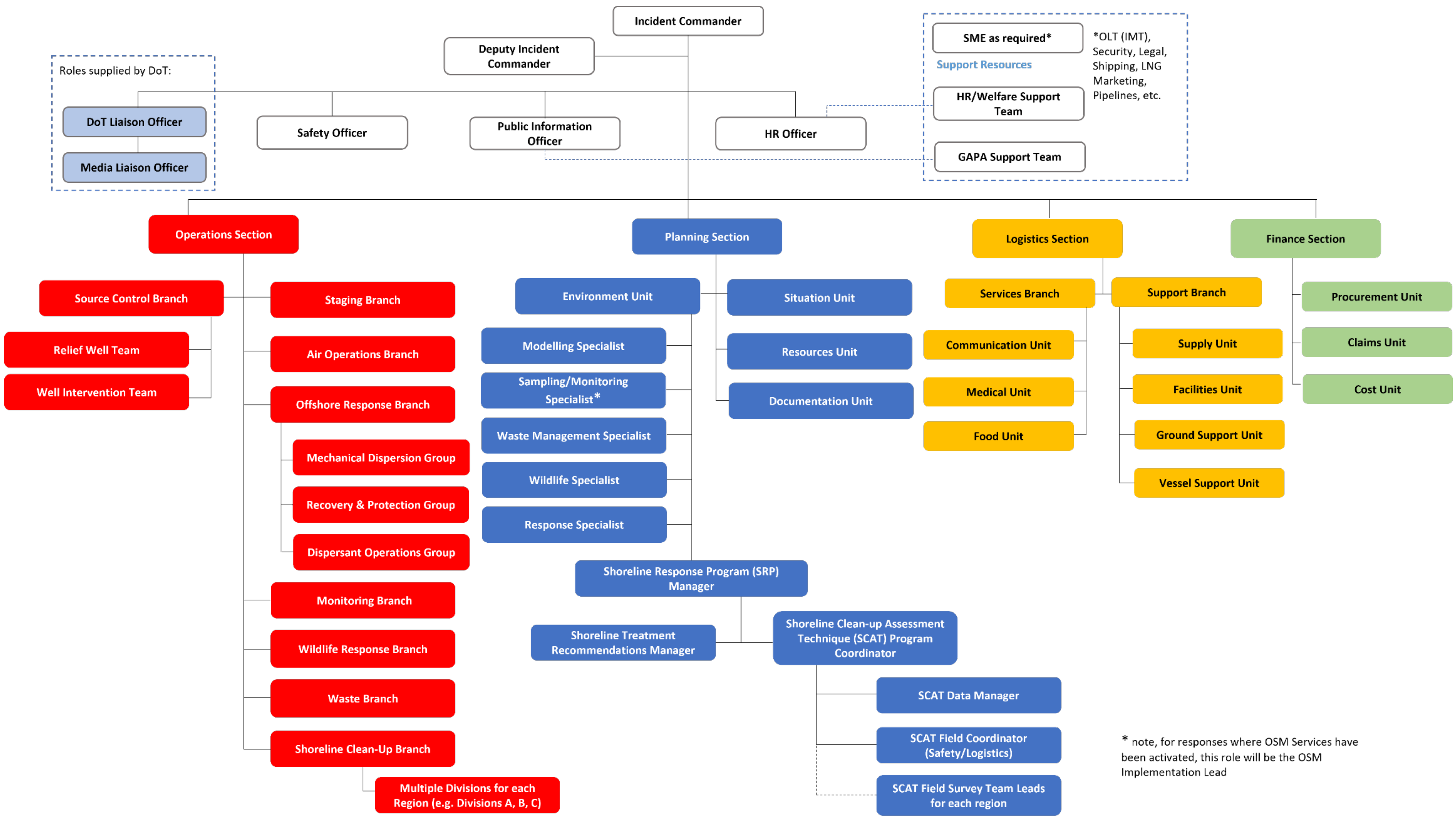

Figure 5-1: Santos incident management team organisational structure

Note: For a Level 2/3 petroleum activity spill where WA DoT is involved as a Control Agency (cross-jurisdictional spills from Commonwealth to State waters), Santos will coordinate with WA DoT to provide spill response capability. Santos' expanded organisational structure for these situations is detailed in Section 4.6.3.

5.2 Roles and responsibilities

The following tables summarise the responsibilities of the Santos CMT (Table 5-1), IMT (Table 5-2), and ERT (Table 5-3) in responding to an incident. Not all the roles listed are shown in Figure 5-1, as some of the roles in Table 5-2 are support roles or are specific to a particular response strategy. Full responsibilities checklists/job cards of each role are described in the Incident Management Plan – Upstream Offshore (SO-00-ZF-00025), Santos Incident Management Handbook and Santos Crisis Management Plan (SMS-HSS-OS05-PD03) to support the incident action planning process.

The IMT and ERT are scalable to the nature and scale of the response (i.e. one person can take on multiple roles or one role can be filled by multiple people, where circumstances permit).

The roles and responsibilities of Santos personnel required to work within WA DoT's organisational structure are summarised in Table 5-5, where WA DoT has responsibilities for spill response as a Control Agency, as per DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements (WA DoT, 2020)

WA DoT will provide a Liaison Officer/Deputy Incident Controller to the Santos IMT in a coordinated response, as outlined for reference (Table 5-4).

DEPWS has agreed in principle, through consultation with the NT Government and the APPEA (now AEP) Oil Spill Preparedness and Response Working Group (20 June 2023), to use the WA DoT Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (WA DoT, 2020) as the basis for developing NT cross-jurisdictional arrangements[11]. Table 5-5 lists indicative roles and responsibilities of Santos personnel required to work within the NT IMT, based on WA DoT (2020) cross-jurisdictional guidance.

Table 5-1: Roles and responsibilities in the Santos Crisis Management Team

Santos CMT role	Main responsibilities
Crisis Management Chair (CEO)	The Crisis Management (CM) Chair (Santos CEO) is responsible for: • Leading crisis management direction • Providing governance and oversight of CMT operations • Providing enterprise and strategic direction to the CMT for resolving the crisis event • Delegating the CM Lead role and accountability to the appropriate ExCom designee • Engaging with the CM Lead to endorse the crisis resolution plan • Liaising with the Santos Board and strategic stakeholders • Providing the full extent of the company's resources to bring about a resolution and recovery from the crisis impact.
CMT Lead/ Duty Manager	The CMT Lead is responsible for: • Determining the need for establishing a Level 3 response and for activating the CMT • Determining which, if any, Crisis Management Support Teams (CMST) are mobilised • Leading the crisis resolution process • Ensuring internal and external notifications are sent to key stakeholders • Using the crisis resolution process to determine enterprise level impacts (potential or actual) and strategic objectives • Ensuring a crisis resolution plan is developed and directing the CMT functions to implement strategies, action plans and tasks • Determining when it is appropriate to conclude the crisis response and stand down all or a portion of the CMT.
CMT Information Management	The CMT Information Managers directly support the CMT by: • Supporting the CMT during crisis management operations • Setting up the crisis management room, assisting with set-up of communications, video conferences and information transfer within the CMT • Advising on CMT operating processes and available resources • Assisting with reserving break-out rooms for the CMT functions and CMSTs • Ensuring CMT crisis resolution forms are used and displayed on the monitors

[11] *A working group is being established to develop the NT cross-jurisdictional arrangements, which once agreed, will be updated into the NTOSCP. In the interim, the WA DoT (2020) cross-jurisdictional guidance can be broadly used by titleholders, as reference for how to support the NT IMT.*

Santos CMT role	Main responsibilities
	• Providing IAP information when an IMT is established • Monitoring and managing the welfare needs of the CMT.
Crisis Management Advisor	The Crisis Management Advisor is responsible for: • Providing CMT process guidance and advice to CMT Lead, Function Leads, and CMST • Supporting and facilitating the crisis resolution planning process • Liaising between the CMT and IMT • Working with CMT Information Managers to manage rosters and handovers for extended CMT operations • Scheduling and facilitating post-crisis debriefings and after-action reviews. The Crisis Management Advisor will support the CMT Lead by: • Facilitating CMT activation requirements with the CMT Lead • Assisting the CMT Lead in maintaining an ongoing assessment of incident potential and analysis of stakeholder impacts • Advising the CMT Lead on CMT structure and requirements for CMST engagement • Coordinating tasks delegated by CMT Lead • Providing tools to the CMT Lead for review and crisis assessment meetings.
CMT Function Leads	CMT Function Leads include Leads for these areas: • Legal Counsel and Risk • Environment Health Safety and Security • Operating Unit Vice President • People • Government and Public Affairs (GAPA) • Media and Communications. The CMT Function Leads are responsible for: • Participating in and contributing to the crisis resolution planning process • Determining critical communications pertaining to their area • Mobilising and coordinating activities of the function's CMST • Advising the CMT Lead on strategic impacts, threats and mitigation created by the crisis event • Developing and implementing strategies to meet objectives endorsed by the CM Chair • Providing support and resources via the CMST to divisional IMTs • Ensuring critical actions, decisions or points of strategic criticality are included in the CMT log • Participating in the crisis management debriefings and after-action reviews.

Table 5-2: Roles and responsibilities in the Santos Incident Management Team

Santos management/ IMT role	Main responsibilities
Vice President Offshore (VPO) Upstream WA/NA	• Depending on the level of the incident, the VPO (and/or their delegate) acts as the primary liaison to the CMT Duty Manager • On activation of the IMT, the VPO is advised by the IMT Duty Manager.
Incident Commander	• Overall management of the incident • Sets response objectives and strategic directions • Oversees the development and implementation of IAPs.
Safety Officer	• Develops and recommends measures for assuring personnel safety • Assesses and/or anticipates hazardous and unsafe situations • May have specialist support as necessary.
Public Information Officer	• Develops and releases information about the incident to media, incident personnel and appropriate agencies and organisations.
Human Resources (HR) Officer	• Advises and assists the Incident Commander, Command Staff and Section Chiefs on any HR-related aspects of an incident.

Santos management/ IMT role	Main responsibilities
Operations Section Chief*	• Leads the Operations Section within the IMT • Manages all tactical operations directly applicable to the primary assignments • Activates and supervises operational elements in accordance with the IAP and directs its implementation.
Division Commander[12]	• Commands an FOB for coordinating resources mobilised to site • Coordinates the field response as outlined in the Barossa First Strike Response Plan and/or IAPs for each operational period developed by the IMT • Establishes and maintains effective operation of the FOB, Divisional Staging Area and any secondary staging areas • Provides advice and input into formulating the IAP for the next operational period. *Refer to the Darwin FOB Duty Card – Division Commander, for further description of roles and responsibilities.*
Source Control Branch Director	• Implements the Source Control Plan (Source Control Planning and Response Guideline – DR-00-OZ-20001) • Activates and supervises source control elements in accordance with the IAP and directs its implementation.
Relief Well Team Leader	• Manages and coordinates relief well design and operations • Coordinates the development of drilling plans and procedures, secures resources and manages relief well operations to ensure the relief well reaches its target • Creates groups as required to acquire relief well MODU, equipment and services • Performs detailed relief well planning.
Subsea Well Intervention Team Leader	• Well intervention activities including initial site survey and debris clearance.
Staging Branch Director	• Supervises and coordinates the Staging Area Managers and their activities, including assigning Staging Area Managers, receiving, maintaining, checking in/out, storing and distributing resources.
Air Operations Branch Director	• Ground-based role • Coordinates air operations section (ICS 220) of the IAP • Provides logistical support to incident aircraft.
Offshore Response Branch Director	• Leads the offshore response activities. Depending on the size and nature of the incident, various groups, teams and task forces will be implemented, including Mechanical Dispersion group, Recovery and Protection group, and Dispersant Operations group. • The Mechanical Dispersion group is responsible for executing mechanical dispersion operations in the designated locations in compliance with the IAP. • The Recovery & Protection group is responsible for the deployment of containment and diversion/protection booming and managing on water recovery operations in the designated locations in compliance with the IAP. • The Dispersant Operations Group is responsible for coordinating all aspects of dispersant operations in compliance with the IAP. For aerial applications, the Group works closely with the Air Operations Branch.
Monitoring Branch Director	• Works closely with the Environment Unit to implement the OSM plans required, based on the nature and scale of the incident.
Wildlife Response Branch Director	• Works with relevant state authorities to implement the OWR plan for the incident, including deploying equipment and personnel required.
Waste Branch Director	• Coordinates the on-site activities of personnel engaged in collecting, storing, transporting and disposing of waste materials, in compliance with the IAP.
Shoreline Clean-up Branch Director	• Leads all shoreline response activities • Works closely with the Shoreline Response Program Manager and shoreline clean-up supervisors and various locations.

[12] *This role is only appointed when an FOB in Darwin assumes control of response operations in the Barossa field.*

Santos management/ IMT role	Main responsibilities
Planning Section Chief*	• Leads the Planning Section within the IMT • Collects, evaluates, disseminates and uses incident information • Maintains status of assigned resources.
Situation Unit Leader	• Collects, processes, and organises incident information relating to escalation, mitigation or intelligence activities taking place in an incident • Prepares future projections of incident growth, maps, and intelligence information.
Resources Unit Leader	• Maintains the status of all assigned tactical resources and personnel at an incident • Oversees the check-in of all tactical resources and personnel • Maintains a status-keeping system indicating current location and status of all the resources.
Documentation Unit Leader	• Maintains accurate, up-to-date incident files including IAPs, incident reports, communication logs, situation status reports etc.
Environment Unit Leader	• Responsible for environmental matters associated with the response, including strategic assessment, modelling, surveillance and environmental monitoring and permitting.
Technical Specialists	• Certain incidents may require Technical Specialists who have specialised knowledge or expertise. Technical Specialists may function within the Planning Section or be assigned wherever their services are required. Santos will activate Technical Specialists, based on the requirements of the incident, through a range of arrangements. Technical Specialists may include: Modelling Specialist, Operational/Scientific Monitoring Specialist, Response Technology Specialist, Waste Management Specialist, etc.
Shoreline Response Program (SRP) Manager	• Reports to the Environment Unit Leader • Manages shoreline response • Provides input to Planning and Operations Section Chiefs on shoreline response program to minimise shoreline impacts and Shoreline Clean-up Assessment Technique (SCAT) program.
SCAT Program Coordinator	• Primary point of contact, through SRP Manager, within the IMT for all SCAT activities • Project manager for the SCAT program and designs and directs the SCAT program for any incidents • Implements and manages the day-to-day activities for the SCAT program including establishing good management practices and safety protocols for the field teams, chairing SCAT Field Survey Team briefings and debriefings and producing daily and weekly summaries of field reports.
SCAT Field Coordinator	• Works with SCAT Program Coordinator to develop daily missions and rolling strategy for the field teams • Provides the necessary logistics and equipment support as required.
SCAT Data Manager	• Reports to the SCAT Program Coordinator • Processes field data, quality assurance, data storage and dissemination within the IMT • Provides the SCAT Field Survey Teams with the maps and data required to conduct their missions.
Shoreline Treatment Recommendations (STR) Manager	• Prepares the Shoreline Treatment Recommendations (STRs) • Works with the Environment Unit to obtain reconnaissance information to assess priority areas for initial SCAT surveys and gain approval for land access where appropriate • Ensures all approvals are obtained (e.g. concerning any endangered species, cultural, historical resources etc.) before undertaking shoreline activities • Works with the Environment Unit's Technical Specialists, subject matter experts (SMEs) and stakeholders to ensure that their requirements and constraints are incorporated into STRs • Works with the Operations Section to obtain advice on the feasibility, practicality and effectiveness of potential treatment strategies and tactics • Tracks the progress of approved STRs to generate and update progress reports.
Logistics Section Chief*	• Provides facilities, services and materials in support of the incident • Participates in the development and implementation of the Logistics Section of the IAP.
Services Branch Director	• When activated, this role is under the supervision of the Logistics Section Chief • Manages all service activities for the incident including the operations of the Communications, Medical and Food Units.

Santos management/ IMT role	Main responsibilities
Support Branch Director	• When activated, this role is under the supervision of Logistics Section Chief • Develops and implements logistics plan in support of the IAP • Supervises the operations of the Supply, Facilities, Ground Support and Vessel Support Units.
Finance Section Chief*	• Manages all financial, administrative and cost analysis aspects of the incident • Supervises members of the Finance Section
Procurement Unit Leader	• Administers all financial matters pertaining to vendor contracts and leases • Undertakes all procurements in accordance with Santos' policies and procedures.
Claims Unit Leader	• Manages and directs all administrative matters pertaining to compensation and claims-related matters for any incident.
Cost Unit Leader	• Collects all cost data • Provides cost estimates and any cost-saving recommendations for the incident.

** Note: The Section Chiefs are supported by various other roles that will be mobilised depending on the severity of the incident.*

Table 5-3: Roles and responsibilities in the field-based response team (ERT)

Field-based position	Main responsibilities
Emergency Commander[13]	• Assesses facility-based oil spill situations / incidents and responds accordingly • Single point of communications between facility/site and IMT • Directs emergency response activities in accordance with the Santos ER principles and philosophy • Considers the *BW Opal* Incident Management Guides for tactical response and develops an incident response strategy • Communicates the incident response actions and delegates actions to the Barossa Production Manager / Incident Commander • Manages the spill incident in accordance with the *BW Opal* Emergency Response Plan, and/or the activity-specific OPEP (this document) • Coordinates medical evacuations as required • Liaises with the Perth IMT Operations Section Chief if/when the IMT is established. *Refer to the BW Opal ERP (BAF-213 6896) for further description of roles and responsibilities.*
Emergency Coordinator	• Establishes and maintains contact with the incident scene • Ensures information is passed to and from the On-Scene Commander, including relevant emergency information from the Command Team time-outs (e.g. source of the spill, if the spill is ongoing or contained, number of personnel responding); also advises On-Scene Commander when the next Command Team time-out will be • Ensures accurate transfer of information from On-Scene Commander to Status Board log person • Communicates with outside assistance (e.g. vessels, aircraft) • If instructed, coordinates activities such as spill control/response strategies • If instructed, liaises with onshore technical authorities and onshore IMT • Informs Emergency Commander of incident and vessel status. *Refer to the BW Opal ERP (BAF-213 6896) for further description descriptions of roles and responsibilities.*
On-Scene Commander (OSC)[14] (ERT Field Team Leader)	• Undertakes command and leads field response as directed by the Emergency Coordinator, where safe to do so • Establishes, when appropriate, a Forward Control Point • Maintains spill responder safety in accordance with Santos' response philosophy • Assures all field and affected area personnel are accounted for • Considers tactical response in accordance with the *BW Opal* Incident Management Guides

[13] *This role is fulfilled by the BW Opal FPSO Offshore Installation Manager (OIM)*
[14] *This role fulfilled by the BW Opal FPSO Senior Operations Technician*

Field-based position	Main responsibilities
	• Deploys and implements spill control/response strategy resources to contain and control the spill incident, as per advice from the Emergency Coordinator / Incident Commander / Division Commander. *Refer to the BW Opal ERP (BAF-213 6896) for further description of roles and responsibilities.*
Medical Evacuation Team	• Manages all medical and transportation requirements related to injured personnel to get them to an appropriate medical facility. *Refer to the Medical Evacuation Procedure (SO-91-IF-00020) for detailed descriptions of roles and responsibilities within the Medical Evacuation Team.*
Source Control Branch	• Responds to incidents involving well loss of containment to stop the flow of oil to sea. *Refer to the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) for detailed descriptions of roles and responsibilities within the Source Control Branch.*
Wildlife Response Branch	• Responds to oiled wildlife incidents to minimise the impacts to wildlife. *Refer to the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) for a description of the wildlife response branch and the Santos Incident Management Handbook for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Branch.*
Monitoring Branch	• Monitors the effectiveness of response strategies • Monitors impacts to sensitive receptors (and their recovery) from an oil spill and associated response actions. *Refer to the Santos Northern Australia OSM-BIP (7715-650-ERP-0003) for detail on OSM roles and responsibilities.*

Table 5-4: Department of Transport roles embedded within Santos' CMT/IMT

WA DoT roles embedded within Santos' CMT/IMT	Main responsibilities
WA DoT Liaison Officer (before WA DoT assuming role of Control Agency) **Deputy Incident Controller – State Waters** (after WA DoT assumes role of Control Agency)	• Provides a direct liaison between the Santos IMT and the State MEECC • Facilitates effective communications between WA DoT's SMPC/ State Maritime Environmental Emergency Coordinator (SMEEC)/Incident Controller and Santos' appointed CMT Lead/Incident Commander • Provides to WA DoT enhanced situational awareness of the incident and the potential impact on State waters • Assists in providing support from WA DoT to Santos • Facilitates providing technical advice from WA DoT to Santos' Incident Commander as required.
Media Liaison Officer	• Provides direct liaison between Santos' media team and WA DoT IMT media team • Facilitates effective communications and coordination between the Santos and WA DoT media teams • Assists in releasing joint media statements and conducts joint media briefings • Assists in releasing joint information and warnings through the WA DoT Information and Warnings team • Offers advice to the Santos Media Coordinator on matters pertaining to WA DoT and wider Government media policies and procedures.

Table 5-5: Santos personnel roles embedded within the State MEECC/DoT IMT/ FOB or NT IMT

Santos roles embedded within the State MEECC/ WA DoT IMT/ FOB or NT IMT	Main responsibilities
CMT Liaison Officer[15]	• Provides a direct liaison between the Santos CMT and the State MEECC / NT IMT • Facilitates effective communications and coordination between the Santos CMT Lead and the SMPC • Offers advice to SMPC on matters pertaining to Santos' crisis management policies and procedures.
Deputy Incident Controller	• Provides a direct liaison between the WA DoT IMT / NT IMT and the Santos IMT • Facilitates effective communications and coordination between the Santos Incident Commander and the WA DoT / NT Incident Controller • Offers advice to the WA DoT/ NT Incident Controller on matters pertaining to Santos' incident response policies and procedures • Offers advice to the Safety Coordinator on matters pertaining to Santos' safety policies and procedures particularly as they relate to Santos employees or contractors operating under the control of the WA DoT IMT / NT IMT.
Deputy Intelligence Officer	• As part of the WA DoT/ NT IMT Intelligence Team, assists the Intelligence Officer in performing their duties in relation to situational awareness • Facilitates providing relevant modelling and predictions from the Santos IMT • Assists in interpreting modelling and predictions originating from the Santos IMT • Facilitates providing relevant situational awareness information originating from the WA DoT IMT / NT IMT to the Santos IMT • Facilitates providing relevant mapping from the Santos IMT • Assists in interpreting mapping originating from the Santos IMT • Facilitates providing relevant mapping originating from the Santos IMT.
Deputy Planning Officer	• As part of the WA DoT / NT IMT Planning Team, assists the Planning Officer in performing their duties related to interpreting existing response plans and developing IAPs and related sub-plans • Facilitates providing relevant IAP and sub-plans from the Santos IMT • Assists in interpreting the Santos OPEP • Assists in interpreting the Santos IAP and sub-plans from the Santos IMT • Facilitates providing relevant IAP and sub-plans originating from the WA DoT IMT / NT IMT to the Santos IMT • Assists in interpreting Santos' existing resource plans. • Facilitates providing relevant components of the resource sub-plan originating from the WA DoT IMT / NT IMT to the Santos IMT. *(Note: This individual must have intimate knowledge of the relevant Santos OPEP and planning processes).*
Environment Support Officer	• As part of the Intelligence Team, assists the Environment Coordinator in performing their duties related to providing environmental support into the planning process • Assists in interpreting the Santos OPEP and relevant Tactical Response Plan (TRP) • Facilitates requesting, obtaining and interpreting environmental monitoring data originating from the Santos IMT • Facilitates providing relevant environmental information and advice originating from the WA DoT IMT / NT IMT to the Santos IMT.
Deputy Public Information Officer[16]	• As part of the Public Information Team, provides a direct liaison between the Santos media team and WA DoT IMT / NT IMT media team • Facilitates effective communications and coordination between the Santos and WA DoT / NT IMT media teams[17]

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[15] The role described as Santos Offshore Liaison Officer in Figure 4-2.

[16] In the event of an incident, Santos can provide the DoT IMT / NT IMT with a list of agencies, organisations, representative bodies, and other stakeholders that were consulted in the development of the Environment Plan to assist DoT with managing and providing public information.

[17] If DoT or NT IMT assumes the role of Control Agency in State / Territory waters, Santos acknowledges that the DoT IMT / NT IMT will be the lead IMT for public information and warnings and community liaison. In such circumstances, Santos retains the right to manage its own media

Santos roles embedded within the State MEECC/ WA DoT IMT/ FOB or NT IMT	Main responsibilities
	• Assists in releasing joint media statements and conducts joint media briefings • Assists in releasing joint information and warnings through the WA DoT / NT IMT Information and Warnings team • Offers advice to the WA DoT / NT IMT Media Coordinator on matters pertaining to Santos' media policies and procedures • Facilitates effective communications and coordination between the Santos and WA DoT / NT IMT Community Liaison teams • Assists in conducting joint community briefings and events • Offers advice to the WA DoT / NT IMT Community Liaison Coordinator on matters pertaining to Santos' community liaison policies and procedures • Facilitates effective transfer of relevant information obtained from the Contact Centre to the Santos IMT.
Deputy Logistics Officer	• As part of the Logistics Team, assists the Logistics Officer in performing their duties related to providing supplies to sustain the response effort • Facilitates acquiring appropriate supplies through Santos' existing OSRL, AMOSC and private contract arrangements • Collects Request Forms from WA DoT / NT IMT to action via the Santos IMT. *(Note: This individual must have intimate knowledge of the relevant Santos logistics processes and contracts).*
Deputy Waste Management Coordinator	• As part of the Operations Team, assists the Waste Management Coordinator in performing their duties related to managing and disposing of waste collected in State waters • Facilitates acquiring appropriate services and supplies through Santos' existing private contract arrangements related to waste management • Collects Waste Collection Request Forms from WA DoT / NT IMT to action via the Santos IMT.
Deputy Finance Officer	• As part of the Finance Team, assists the Finance Officer in performing their duties related to setting up and paying accounts for those services acquired through Santos' existing OSRL, AMOSC and private contract arrangements • Facilitates communicating financial monitoring information to Santos to allow tracking of the overall cost of the response • Assists the Finance Officer in tracking financial commitments throughout the response, including the supply contracts commissioned directly by WA DoT / NT IMT and to be charged back to Santos.
Deputy Operations Officer	• As part of the Operations Team, assists the Operations Officer in performing their duties related to implementing and managing operational activities undertaken to resolve an incident • Facilitates effective communications and coordination between the Santos Operations Section and the WA DoT / NT IMT Operations Section • Offers advice to the WA DoT / NT IMT Operations Officer on matters pertaining to Santos incident response procedures and requirements • Identifies efficiencies and helps resolve potential conflicts around resource allocation and simultaneous operations of Santos and WA DoT / NT IMT response efforts.
Deputy Division Commander (FOB)	• As part of the Field Operations Team, assists the Division Commander in performing their duties related to overseeing and coordinating field operational activities undertaken in line with the IMT Operations Section's direction • Provides a direct liaison between Santos' FOB(s) and the WA DoT FOB / NT IMT • Facilitates effective communications and coordination between Santos FOB Operations Commander and the WA DoT / NT IMT Division Commander • Offers advice to the WA DoT FOB / NT IMT Operations Commander on matters pertaining to Santos' incident response policies and procedures • Assists the Safety Coordinator deployed in the FOB in performing their duties, particularly as they relate to Santos employees or contractors

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interests, but acknowledges the strong preference for DoT and Santos to issue joint media statements and conduct joint media conferences and the importance of close liaison between the respective media teams.

Santos roles embedded within the State MEECC/ WA DoT IMT/ FOB or NT IMT	Main responsibilities
	• Offers advice to the Senior Safety Officer deployed in the FOB on matters pertaining to Santos' safety policies and procedures.

5.3 Cost recovery

As required under Section 571(2) of the OPGGS Act 2006, Santos has financial assurances in place to cover any costs, expenses and liabilities arising from carrying out its petroleum activities, including major oil spills. This includes costs incurred by relevant Control Agencies (e.g. WA DoT / NT DEPWS) and third-party spill response service providers.

5.4 Training and exercises

To refresh IMT roles and responsibilities and familiarise personnel with OPEP processes and arrangements, IMT workshops are conducted as per the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).

To familiarise the IMT with functions and processes, an OPEP desktop and activation exercise is undertaken as per the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001). Exercise planning takes into consideration virtual/remote access requirements and government-mandated border restrictions.

All workshops and exercises undertaken are recorded in the Santos Environmental, Health and Safety (EHS) Toolbox, with the key recommendations recorded and tracked.

5.4.1 Incident management team training and exercises

Santos provides training to its personnel to fill all required IMT positions.

Competency is maintained through participation in regular response exercises and workshops. Table 5-6 summarises the exercise and training requirements for Santos' IMT members.

Table 5-6: Training and exercise requirements for incident management team positions

IMT role	Exercise	Training
Incident Commander	One Level 3 exercise annually or two Level 2 desktop exercises annually[18]	• PMAOMIR418 • AMOSC – IMO3 (International Maritime Organisation) equiv. Oil Spill Response Command & Control
Operations Section Chief / Source Control Branch Director		• PMAOMIR322 • AMOSC – IMO3 equiv. Oil Spill Response Command & Control
Planning Section Chief Logistics Section Chief Environment Unit Leader		• PMAOMIR322 • AMOSC – IMO2 equiv. Oil Spill Response Management
Safety Officer Supply Unit Leader Geographic Information System (GIS) Team Leader Data Manager[19] HR Officer Situation Unit Leader Documentation Unit Leader IMT Log and Situation Unit Leader		• PMAOMIR322 • AMOSC – Oil Spill Response Familiarisation Training

[18] *All IMT members are required to participate in at least one Level 3 exercise every 2 years.*

[19] *Data Manager is an administrative support role, not an IMT role, but is included here for completeness.*

IMT role	Exercise	Training
Relief Well Team Leader Well Intervention Team Leader		• Drilling Well Control accredited training through International Well Control Forum (IWCF) Level 4 – Well Site Supervisor

5.4.2 Oil spill responder training

Santos has an internal capability of trained oil spill responders who can be deployed in the field in a spill response and has access to external, trained spill responder resources (Table 5-7).

Table 5-7: Spill responder personnel resources

Responder	Role	Training	Available Number
Santos AMOSC Core Group responders	Santos personnel trained and competency assessed by AMOSC as the AMOSC Core Group. Deployed by IMT for spill response operations.	AMOSC Core Group Workshop (refresher training every 2 years). AMOSC – IMO1 equiv. Oil Spill Response Operations	16[20]
Santos-trained personnel in Darwin	Santos personnel located in Darwin trained to a minimum recognised oil spill responder training level.	IMO1 – Oil Spill Response Operations	6
Santos Facility ERTs	Present at Facility for first-strike response to incidents.	Internal Santos training and exercises as defined in each facility's ERP Emergency Commander to have AMOSC – Oil Spill Response Familiarisation Training.	One ERT per operational facility per shift
Santos Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircraft.	AMOSC – Aerial Surveillance Course (refresher training every 3 years).	7
Santos Oil Spill Response Team	Provides a pool of Santos employees trained to perform leadership roles in an IMT or in the field during an oil spill response.	As per the Santos oil spill response (OSR) training matrix.	140[21]
AMOSC Core Group oil spill responders	Industry personnel as the AMOSC Core Group, available to Santos under the AMOSPlan. For providing incident management (IMT) and operations (field response) assistance.	AMOSC Core Group Workshop (refresher training every 2 years). AMOSC – IMO1 equiv. Oil Spill Response Operations and/or IMO2 equiv. Oil Spill Response Management.	As defined in Core Group Member Reports[22] Target of 100 members (minimum 84, maximum 140). Refer to AMOSC Core Group Program and Policies V2.0 (AMOSC, 2024)
OSRL oil spill response personnel	OSRL professionals, providing technical, incident management and operational advice and assistance available under Santos–OSRL contract.	As per OSRL training and competency matrix.	18 responders guaranteed 80 responders may be approved under best endeavours
TRG response personnel	Emergency response personnel provided by arrangement with Santos.	As per TRG training and competency matrix.	60

[20] *Santos has a commitment to increase to 21 Core Group personnel (including 4 based in Darwin) before commencing operations.*

[21] *Note: The number of members in this pool is not directly related to the number of people required in the IMT or field at any one time. Rather it is a resource pool able to be called upon to fill roles in the IMT and field. Santos has arrangements in place to meet any shortfalls during an incident response, as detailed in Section 4.7.4.*

[22] *A total of 100 personnel in the Core Group as of July 2024 (AMOSC Member's website).*

Responder	Role	Training	Available Number
AMOSC staff	Professionals, providing technical, incident management and operational advice and assistance available under Santos–AMOSC contract.	As per AMOSC training and competency matrix.	16[23]
Santos Source Control Personnel	Manage and coordinate source control strategies including relief well drilling and subsea intervention.	Internal Santos training and exercises. IWCF Level 4 certification.	60[24]
OWR roles	Refer to Section 16 and Appendix M		
OSM services provider	Refer to Section 9.1 of the Northern Australia OSM-BIP (7715-650-ERP-0003)		
Level 1 Oiled wildlife responders (workforce hire)	Provide oiled wildlife support activities under supervision.	No previous training required; on-the-job training provided.	Nominally over 1,000
Shoreline clean-up personnel (workforce hire)	Manual clean-up activities under supervision.		

In addition to the resources listed in Table 5-7, these resources are available for spill response and may be activated by the relevant Control Agency:

- National Plan: National Response Team – Trained oil spill response specialists, including aerial observers, containment and recovery crews, and shoreline clean-up personnel, will be deployed under the direction of the relevant Control Agency in a response. The National Response Team is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA, 2021b).
- NT Oil Spill Contingency Plan (NTOSCP): NT Response Team are available to assist under the jurisdiction of the NT IMT. NT Response Team members remain trained and accredited in line with the NTOSCP.
- WA SHP-MEE: State Response Team (SRT) – Oil pollution response team available to assist under the jurisdiction of the WA DoT in State waters. SRT members remain trained and accredited in line with the SHP-MEE requirements (WA DoT, 2024).

In the event of a spill, the trained spill responders listed in Table 5-7 would be required to undertake various roles in key spill response operations, including shoreline protection, shoreline clean-up and OWR.

In the event of a spill, Team Leader roles for protection and deflection and shoreline clean-up would be filled through Santos' AMOSC Core Group responders and then industry Core Group responders.

5.5 Response testing arrangements and audits

Santos has oil spill response testing arrangements in place in accordance with the Santos Offshore Oil Spill Response Readiness Guideline (7710-650-GDE-0001), which provides a process for continually monitoring OSRO capability. This also includes regular oil spill response equipment inventory checks from the various sources. Testing key response provider arrangements may be done as part of larger exercises or as standalone tests where the capability and availability of resources through the response provider are assessed against the performance requirement.

5.5.1 Testing arrangements

Not all spill preparedness and response arrangements will be tested simultaneously. The frequency of testing will relate to the potential spill level, spill risk and complexity of response.

Santos uses a range of tests to ensure the various response arrangements function as required, including:

- contract/ plan review
- audit

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[23] *AMOSC has a permanent staff of 16 available on a 24/7 basis (AMOSC Plan, 2021),12 of which are available for field response, and 4 for administrative/management support roles.*

[24] *Made up of Santos drilling and completions (D&C) staff who are members of the Santos OSR Team, and other D&C staff.*

- notification/ communication check
- desktop exercise
- deployment exercise
- Level 2/3 IMT exercise.

These tests, and the testing schedule, are detailed in full in the Santos Offshore Oil Spill Response Readiness Guideline (7710-650-GDE-0001). Objectives are set for the various tests identified for each of the response arrangements. The effectiveness of response arrangements against these objectives are assessed using pre-identified key performance indicators (KPIs). The objectives and KPIs for testing the response arrangements specified in this OPEP are detailed in Appendix R.

The tests are carried out for all in-force OSCPs / OPEPs. In accordance with regulation 22(14) of the OPGGS (E) regulations, the spill response arrangements need to be tested:

a) When they are introduced;

b) When they are significantly amended;

c) Not later than 12 months after the most recent test;

d) If a new location for the activity is added to an EP after the response arrangements have been tested, and before the next test is conducted—testing the response arrangements in relation to the new location as soon as practicable after it is added to the EP;

e) If a facility becomes operational after the response arrangements have been tested and before the next test is conducted—testing the response arrangements in relation to the facility when it becomes operational.

Table 5-8 describes response arrangements specific to regulation 22(14)(e) at the FPSO hook-up and commissioning activities (which commences at the FPSO Arrival, Hook-up and Cold Commissioning phase). In addition to the items in Table 5-8, the relevant items for Barossa Production Operations in the existing Santos testing arrangements plan in Appendix R are also applicable.

Table 5-8: Testing of response arrangements for Barossa Production Operations

Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
Emergency Response Communications	Notification / communications check	Within 1 month of initiating FPSO Hook-up and Commissioning activities. Thereafter on a quarterly basis.	To test emergency communications between the *BW Opal* FPSO and the Perth-based IMT	• To successfully test emergency response communications between the *BW Opal* FPSO and the Perth IMT • To ensure communication protocols and contacts are current and correct • To update communications protocols and details if required.
Level 1: Barossa Production Operations	First Strike Test – Tracking Buoys Communication/ Tracking software Test	Within 1 month of initiating FPSO Hook-up and Commissioning activities Thereafter, 6-monthly, as per the Testing Arrangements Plan (Appendix R)	To confirming response readiness for Tracking buoys	• Tracking Buoys pass functional test as per operational instructions
Level 2: Barossa Production Operations	Level 2 - Facility Specific IMT Exercise	Level 2 exercise: Within 3 months of initiating FPSO Hook-up and Commissioning activities	Exercise to test elements of the Barossa Oil Spill First Strike Response Plan To confirm the Santos IMT activations and external support	• Santos IMT activations and notifications confirmed as per OPEP arrangements • IMT related external capability arrangements confirmed to be in place

Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
		Thereafter, annually as per Level 2/3 IMT exercise in the Testing Arrangements Plan (Appendix R)	notifications for the new facility / activity as per the OPEP	

All testing activities are documented, and all reports generated will be saved in Santos's EHS Toolbox system. Once completed, records of testing arrangements are entered into the Santos EHS Toolbox and any actions, recommendations, learnings and/or corrective actions identified are assigned a responsible party for completion and tracked to closure. The status of completion is tracked through the 'Action module' in the EHS Toolbox and communicated widely through monthly EHS KPI reporting.

Source control testing arrangements have been formulated with reference to industry guidelines including the APPEA Offshore Titleholders Source Control Guideline (June 2021) and the NOPSEMA Information Paper: Source Control Planning and Procedures IP1979 (June 2021).

Source control objectives and KPIs are developed to test the response arrangements specified in this OPEP and the Source Control Planning and Response Guideline (DR-00-OZ- 20001). In addition to objectives and KPIs, test frequency and type of test are also detailed in Appendix R.

For each source control exercise, a copy of the exercise materials is recorded in the EHS Toolbox. Action items identified are tracked in EHS Toolbox to completion. Lessons learnt are incorporated into Santos guidelines and procedures as part of a process of continual improvement.

5.5.2 Audits

Oil spill response audits will follow the Santos Assurance Management Standard (SMS-MS15.1) and are scheduled as per Santos' annual Assurance Schedule. Audits help identify and address any deficiencies in systems and procedures. At the conclusion of the audit, any opportunities for improvement and/or corrective actions required (non-conformances) will be formally noted and discussed, with corrective actions developed and accepted. In some instances, audits may conclude with potential amendments to the OPEP.

Multiple oil spill response organisations are engaged by Santos. These organisations are responsible for auditing and maintaining their own capacity. The Santos Emergency Response Coordinator (Oil Spill) oversees the audit and maintenance programs of its service providers through regular reporting requirements and any third-party assurance activities, including:

- The deployment readiness and capability of AMOSC's oil spill response equipment and resources in Geelong, Fremantle, Exmouth and Broome is audited every 2 years under the direction of AMOSC's participating members. The intent is to assure Santos and associated members about AMOSC's ability to respond to an oil spill incident as per the methods and responsibilities defined in OPEPs and AMOSC's Service Level Statement.
- The deployment readiness and capability of OSRL's oil spill response equipment and personnel is audited every 2 years by the Oil Spill Response Coordinator. The intent is to assure Santos of OSRL's ability to respond to an oil spill incident as per the methods and responsibilities defined in Santos' OPEPs and OSRL's SLA.

6. Response strategy selection

6.1 Spill scenarios

This OPEP outlines strategies, actions and supporting arrangements applicable for all credible oil spill events associated with Barossa Production Operations activities. Of the credible spill scenarios identified in the Barossa Production Operations EP (BAA-200 0637; Section 7), a subset have been selected to represent worst-case spills from a response perspective, taking into account these characteristics:

- they represent all hydrocarbon types that could be spilt during Barossa Production Operations activities
- they represent maximum credible release volumes
- those scenarios that represent the greatest spatial extent (from a response perspective) based on surface oil and shoreline accumulation, because these are the key factors contributing to response
- proximity to sensitive receptors, shorelines, Territory / State and Commonwealth boundaries etc.

The credible scenarios for unplanned release of liquid hydrocarbons are presented in Table 6-1. The Barossa Production Operations EP (BAA-200 0637; Sections 7.6 to 7.12) details how these credible spill scenarios were derived. The following worst case scenarios were used to inform the resourcing requirements in this OPEP: Surface release of condensate from the FPSO (16,700 m^3); surface release of HFO from the offtake tanker (460 m^3), surface release of MGO from the FPSO (2,418 m^3), and surface release of MDO from a vessel (500 m^3).

Appendix A describes the characteristics and behaviour associated with the hydrocarbons that may unintentionally be released.

Table 6-1: Credible scenarios for unplanned release of liquid hydrocarbons for Barossa Production Operations activities

Scenario	Volume	Release duration	Assessed as worst-case in the EP
Barossa Condensate			
Release of condensate from a subsea system rupture from a major loss of integrity, causing a large leak that is detected by the FPSO systems†.	9.8 m^3	Approximately 1 hour	-
Release of condensate from a subsea system rupture as a result of anchor/chain drag or dropped object during Drilling or SURF Installation activities, causing a large leak†.	9.8 m^3	Approximately 1 hour	-
Subsea release of condensate from a production well as a result of intervening the well via light well intervention vessel†.	5.01 m^3	Approximately 2 hours	-
Subsea release of condensate from a production well as a result of anchor/chain drag or dropped object during Drilling or SURF activities†.	850 m^3	90 days	-
Subsea release of condensate from a production well as a result of an internal influence, such as superposition of failures of multiple barriers†.	692 m^3	90 days	-
Surface release of condensate from the FPSO or offtake tanker as a result of an external impact (vessel collision), which ruptures a condensate storage tank.	16,700 m^3	1 hour	Yes (refer to Table 6-4 and Table 6-5 for stochastic spill modelling results)
Surface release of condensate from a rupture or leak in the offtake equipment as a result of an external impact (station loss) or internal influence (such as integrity loss of equipment).	465 m^3	5 minutes	-
Surface release of condensate from process upset on FPSO (liquid carry-over to flare).	6 m^3	5 minutes	-
HFO			
A surface release of HFO from the offtake tanker as a result of external impact (vessel collision), which ruptures an HFO tank on the offtake tanker.	460 m^3	1 hour	Yes (refer to Table 6-6 and Table 6-7 for stochastic spill modelling results)
MGO / MDO			
Surface release of MGO from the FPSO as a result of external impact (vessel collision), which ruptures an FPSO MGO tank*	2,418 m^3	1 hour	Yes (refer to Table 6-8 and Table 6-9 for stochastic spill modelling results)
Surface release of MGO due to leaking or ruptured bunker transfer equipment.	10 m^3	3 minutes	-
Surface release of MDO from a vessel as a result of an external impact (vessel collision), which ruptures an MDO tank.	500 m^3	1 hour	Yes (refer to Table 6-10 and Table 6-11 for stochastic spill modelling results)

** MDO was modelled for this scenario, as comparison of MGO and MDO properties shows that MDO is marginally the more persistent product, and hence the more conservative of the two hydrocarbon types.*

† These subsea release scenarios used the representative oil spill modelling of a total discharge volume of 1,383 m^3 (albeit a higher volume).

6.2 Response planning thresholds

Environmental impact assessment thresholds are addressed in Section 7.7.4 of the EP. In addition to these impact assessment thresholds, response thresholds have been developed for response planning to determine the conditions under which response strategies would be effective. These thresholds are provided as a guide for response planning and are based on case studies that have demonstrated some response strategies require certain oil spill thicknesses and conditions to be effective.

For example, containment and recovery effectiveness drops significantly with reduced oil thickness (McKinney and Caplis, 2017; NOAA, 2013). McKinney and Caplis (2017) tested the effectiveness of various oil skimmers at different oil thicknesses. Their results showed that the oil recovery rate of skimmers dropped significantly when oil thickness was <50 g/m^2.

Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50–100 g/m^2 on the sea surface. EMSA (2010) recommends thin layers of spilled hydrocarbons should not be treated with dispersant. This includes Bonn Agreement Oil Appearance Codes (BAOAC) 1–3 (EMSA, 2010).

Table 6-2 lists the response planning thresholds.

Table 6-2: Surface and shoreline hydrocarbon thresholds for response planning

Hydrocarbon concentration (g/m²)	Description
≥1	Used (in part) for OSM planning, as described in the Santos Northern Australia OSM-BIP (7715-650-ERP-0003)
≥50	Estimated minimum floating hydrocarbon threshold for containment and recovery and surface dispersant application
≥100	Estimated floating hydrocarbon threshold for effective containment and recovery and surface dispersant application Estimated minimum shoreline accumulation threshold for shoreline clean-up

6.3 Stochastic spill modelling results

The selected worst-case spill scenarios were modelled for Barossa Production Operations activities using a stochastic approach. For spill response preparedness, outputs relating to floating oil and oil accumulated on the shoreline are most relevant (i.e. oil that can be diverted, contained, collected or dispersed by using spill response strategies) for allocating and mobilising spill response resources. Therefore, these are the results presented in this OPEP for primary consideration.

No floating or shoreline oiling, ≥1 g/m^2 and ≥10 g/m^2 respectively, was predicted for the subsea release of condensate from production wells and subsea systems scenarios[25] and hence no results have been included.

A total of 100 spill trajectories were simulated for each season (i.e. 300 in total) using a number of unique environmental conditions sampled from historical metocean data. The FPSO condensate storage tank rupture, export tanker HFO tank rupture and FPSO MGO fuel tank rupture were all tracked for 40 days. The IMR vessel MDO fuel tank rupture was tracked for 30 days.

The worst-case floating oil exposure and probability (percentage) of total contact at ≥1 g/m² for each scenario for all environmental value areas is presented in Table 6-4, Table 6-6, Table 6-8, and Table 6-10. The shoreline oil accumulation for environmental values for each scenario is presented in Table 6-5, Table 6-7, Table 6-9 and Table 6-11. For each modelled scenario, these results represent the worst-case floating or shoreline oil contact probability for each receptor from all stochastic modelling runs (300 simulations) across all seasons.

Table 6-3 shows the entrained and dissolved spill modelling results. The shortest time to coastal waters jurisdictional boundaries is 1 hour for NT waters for the surface release of MDO from a vessel (500 m^3) scenario, with a probability of 67% and 14% for entrained and dissolved hydrocarbons, respectively. Refer to Section 7.7.4 of the EP for dissolved and entrained thresholds and Section 7.7.6 for potential impacts to receptors.

[25] These subsea release scenarios used the representative oil spill modelling of a total discharge volume of 1,383 m^3 (albeit a higher volume).

Table 6-3: Entrained and dissolved stochastic modelling results for NT and WA waters

Scenario and coastal waters	Probability (%) of entrained hydrocarbon exposure at ≥10 ppb	Min. time before entrained exposure ≥10 ppb	Probability (%) of dissolved hydrocarbon exposure at ≥10 ppb	Min. time before dissolved exposure at ≥10 ppb
Surface release of condensate from the FPSO (16,700 m^3 released over 1 hour)				
NT waters	1.67	34 days: 5 hours	0.33	34 days: 5 hours
WA waters	1.33	28 days: 7 hours	0.67	28 days: 15 hours
Surface release of HFO from the offtake tanker (460 m^3 released over 1 hour)				
NT waters	-	-	-	-
WA waters	-	-	-	-
Surface release of MGO from the FPSO (2,418 m^3 released over 1 hour)*				
NT waters	1.33	18 days: 22 hours	-	-
WA waters	1.33	26 days: 9 hours	-	-
Surface release of MDO from a vessel (500 m^3 released over 1 hour)				
NT waters	67.67	1 hour	14	1 hour
WA waters	-	-	-	-

Note: '-' denotes no result predicted.

** MDO was modelled for this scenario, as comparison of MGO and MDO properties shows that MDO is marginally the more persistent product, and hence the more conservative of the two hydrocarbon types.*

Source: RPS, 2023

Table 6-4: Spill modelling results – floating oil from surface release of condensate from the FPSO (16,700 m^3 released over 1 hour)

Location	Total contact probability (%) floating oil ≥1 g/m²	Min. arrival time floating oil ≥1 g/m²	Total contact probability (%) floating oil ≥10 g/m²	Min. arrival time floating oil ≥10 g/m²	Total contact probability (%) floating oil ≥50 g/m²	Min. arrival time floating oil ≥50 g/m²
Echo Shoals*	0.67	9 days: 2 hours	<0.33	NC	<0.33	NC
Flat Top Bank*	0.33	26 days: 1 hour	<0.33	NC	<0.33	NC
Indonesia East and Timor-Leste	1.00	11 days: 16 hours	0.33	29 days:7 hours	<0.33	NC
Margaret Harries Bank*	3.67	6 days: 6 hours	1.00	9 days: 16 hours	<0.33	NC
Minor Indonesian islands	0.33	18 days: 23 hours	<0.33	NC	<0.33	NC
Newby Shoal*	0.67	23 days: 17 hours	<0.33	NC	<0.33	NC
Northern Arafura Australian Marine Park (AMP)*	0.67	21 days: 14 hours	<0.33	NC	<0.33	NC
Outer Oceanic Shoals AMP*	2.33	2 days: 19 hours	0.67	3 days: 12 hours	0.33	3 days: 13 hours
Sahul Banks*	0.67	17 days: 8 hours	<0.33	NC	<0.33	NC
Sunrise Bank*	4.67	1 day: 13 hours	1.67	2 days: 2 hours	0.67	2 days: 4 hours
The Boxers Area*	1.67	4 days: 12 hours	0.33	4 days: 15 hours	0.33	4 days: 18 hours
Western Sahul Bank Shoals*	0.33	34 days: 22 hours	<0.33	NC	<0.33	NC

** Submerged receptor that has no features above the sea surface. Modelling indicates 'contact' with these receptors occurs when the hydrocarbons pass over the receptor on the sea surface.*

NC: No contact to receptor predicted for specified threshold

Note: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

Source: RPS, 2023

Table 6-5: Spill modelling results – shoreline accumulation from surface release of condensate from the FPSO (16,700 m³ released over 1 hour)

Location	Total probability (%) shoreline oil accumulation ≥10 g/m²	Min. arrival time shoreline oil accumulation ≥10 g/m²	Total probability (%) shoreline oil accumulation ≥100 g/m²	Min. arrival time shoreline oil accumulation ≥100 g/m²	Peak volume ashore (m^3)	Max. length of shoreline oiled (km) ≥100 g/m²
Cartier Island AMP	0.67	34 days: 21 hours	0.33	39 days: 23 hours	8	1
Cobourg Peninsula – Nhulunbuy	0.33	31 days: 22 hours	<0.33	NC	2	NC
Indonesia East and Timor-Leste	3.67	9 days: 22 hours	1.67	11 days: 7 hours	156	28
Minor Indonesian islands	2.00	12 days: 7 hours	1.00	18 days: 15 hours	41	7

NC: No contact to receptor predicted for specified threshold

Note: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

Source: RPS, 2023

Table 6-6: Spill modelling results – floating oil from surface release of HFO from the offtake tanker (460 m³ released over 1 hour)

Location	Total contact probability (%) floating oil ≥1 g/m²	Min. arrival time floating oil ≥1 g/m²	Total probability (%) floating oil ≥10 g/m²	Min. arrival time floating oil ≥10 g/m²	Total contact probability (%) floating oil ≥50 g/m²	Min. arrival time floating oil ≥50 g/m²
Arnhem AMP*	1.33	18 day: 14 hours	<0.33	NC	<0.33	NC
Ashmore Reef AMP	1.33	29 days: 14 hours	<0.33	NC	<0.33	NC
Ashmore-Cartier – Outer*	1.67	19 days: 19 hours	<0.33	NC	<0.33	NC
Britomart Shoal*	0.33	33 days: 2 hours	<0.33	NC	<0.33	NC
Central Arnhem AMP*	2.00	19 days: 9 hours	<0.33	NC	<0.33	NC
Cobourg Peninsula-Nhulunbuy	1.00	19 days: 2 hours	<0.33	NC	<0.33	NC
Cape Hotham#	0.67	36 days: 10 hours	<0.33	NC	<0.33	NC
Echo Shoals*	5.67	6 days: 19 hours	0.67	7 days: 23 hours	<0.33	NC
Fantome Shoals*	1.67	17 days: 7 hours	<0.33	NC	<0.33	NC
Flat Top Bank*	0.67	31 days: 6 hours	<0.33	NC	<0.33	NC
Hancox Shoal*	0.67	35 days: 18 hours	<0.33	NC	<0.33	NC
Hibernia Reef*	0.67	31 days: 12 hours	<0.33	NC	<0.33	NC

Location	Total contact probability (%) floating oil ≥1 g/m²	Min. arrival time floating oil ≥1 g/m²	Total probability (%) floating oil ≥10 g/m²	Min. arrival time floating oil ≥10 g/m²	Total contact probability (%) floating oil ≥50 g/m²	Min. arrival time floating oil ≥50 g/m²
Indonesia East and Timor-Leste	2.67	8 days: 14 hours	0.33	8 days: 17 hours	<0.33	NC
Johnson Bank*	0.33	34 days: 15 hours	<0.33	NC	<0.33	NC
Lowry Shoal*	0.67	35 days: 15 hours	<0.33	NC	<0.33	NC
Margaret Harries Bank*	6.33	3 days: 9 hours	2.00	3 days: 11 hours	<0.33	NC
Marsh Shoal*	0.33	37 days: 5 hours	<0.33	NC	<0.33	NC
Minor Indonesian islands	0.67	16 days: 13 hours	<0.33	NC	<0.33	NC
Moresby Shoals*	0.67	35 days: 6 hours	<0.33	NC	<0.33	NC
Newby Shoal*	1.00	25 days: 7 hours	<0.33	NC	<0.33	NC
Northern Arafura AMP*	4.00	7 days: 9 hours	0.33	7 days: 11 hours	<0.33	NC
NT waters	1.00	16 days: 3 hours	0.33	19 days: 3 hours	<0.33	NC
Orontes Reef*	0.33	30 days: 13 hours	<0.33	NC	<0.33	NC
Outer Oceanic Shoals AMP*	6.00	1 day: 9 hours	2.00	2 days: 5 hours	<0.33	NC
Sahul Banks*	4.33	11 days: 8 hours	<0.33	NC	<0.33	NC
Shepparton Shoal*	0.67	23 days: 6 hours	<0.33	NC	<0.33	NC
Skottowe Shoal*	0.67	35 days: 14 hours	<0.33	NC	<0.33	NC
Southern Arafura AMP	2.33	5 days: 10 hours	0.33	18 days: 22 hours	<0.33	NC
Sunrise Bank*	15.33	1 day: 6 hours	7.67	1 day: 6 hours	0.33	37
The Boxers Area*	2.67	2 days: 23 hours	0.67	3 days: 22 hours	<0.33	NC
Tiwi Islands	0.33	35 days: 16 hours	<0.33	NC	<0.33	NC
Van Cloon-Deep Shoals*	1.00	21 days: 16 hours	<0.33	NC	<0.33	NC
Van Diemen Gulf Coast	0.67	37 days: 6 hours	<0.33	NC	<0.33	NC
Van Diemen Gulf Shoals*	0.67	37 days: 5 hours	<0.33	NC	<0.33	NC

Location	Total contact probability (%) floating oil ≥1 g/m²	Min. arrival time floating oil ≥1 g/m²	Total probability (%) floating oil ≥10 g/m²	Min. arrival time floating oil ≥10 g/m²	Total contact probability (%) floating oil ≥50 g/m²	Min. arrival time floating oil ≥50 g/m²
Vernon Islands Conservation Reserve (CR)	0.67	35 days: 20 hours	0.33	NC	<0.33	NC
WA waters	1.33	29 days: 9 hours	NC	NC	NC	NC
Western Sahul Bank Shoals*	3.67	13 days: 12 hours	<0.33	NC	<0.33	NC

**Submerged receptor that has no features above the sea surface. Modelling indicates 'contact' with these receptors occurs when the hydrocarbons pass over the receptor on the sea surface.*

NC: No contact to receptor predicted for specified threshold

Note: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

 # Djukbinj National Park polygon named in the modelling report (RPS, 2023) refers to the area Cape Hotham. There is no hydrocarbon contact with Djukbinj National Park.

Source: RPS, 2023

Table 6-7: Spill modelling results – shoreline accumulation from surface release of HFO from the offtake tanker (460 m³ released over 1 hour)

Location	Total probability (%) shoreline oil accumulation ≥10 g/m²	Min. arrival time shoreline oil accumulation ≥10 g/m²	Total probability (%) shoreline oil accumulation ≥100 g/m²	Min. arrival time shoreline oil accumulation ≥100 g/m²	Peak volume ashore (m³)	Max. length of shoreline oiled (km) ≥100 g/m²
Ashmore Reef AMP	2.67	23 days: 23 hours	1.67	29 days: 6 hours	195	28
Beagle Gulf – Darwin Coast	0.33	37 days: 18 hours	<0.33	NC	<1	NC
Cobourg Peninsula – Nhulunbuy	1.67	18 days: 20 hours	1.33	30 days: 11 hours	298	75
Cape Hotham#	0.67	36 days: 17 hours	0.67	36 days: 19 hours	29	6
Indonesia East and Timor-Leste	7.33	9 days: 4 hours	4.66	9 days: 6 hours	367	93
Minor Indonesian islands	3.00	12 days: 13 hours	1.67	13 days: 21 hours	174	40
Tiwi Islands	0.33	37 days: 5 hours	0.33	37 days: 9 hours	278	61
Van Diemen Gulf Coast	0.67	37 days: 6 hours	0.67	37 days: 7 hours	46	11
Vernon Islands CR	0.67	35 days: 19 hours	0.67	35 days: 22 hours	227	17

NC: No contact to receptor predicted for specified threshold

Note: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

 # Djukbinj National Park polygon named in the modelling report (RPS, 2023) refers to the area Cape Hotham. There is no hydrocarbon contact with Djukbinj National Park. *Source: RPS, 2023*

Table 6-8: Spill modelling results – floating oil from surface release of MGO† from the FPSO (2,418 m^3 released over 1 hour)

Location	Total contact probability (%) floating oil ≥1 g/m²	Min. arrival time floating oil ≥1 g/m²	Total probability (%) floating oil ≥10 g/m²	Min. arrival time floating oil ≥10 g/m²	Total contact probability (%) floating oil ≥50 g/m²	Min. arrival time floating oil ≥50 g/m²
Indonesia East and Timor-Leste	0.33	15 days: 7 hours	<0.33	NC	<0.33	NC
Margaret Harries Bank*	1.33	5 days: 11 hours	0.33	6 days: 5 hours	<0.33	NC
Outer Oceanic Shoals AMP*	1.00	3 days: 2 hours	0.67	3 days: 3 hours	0.33	3 days, 11 hours
Sunrise Bank*	3.33	1 day: 19 hours	2.00	1 day: 19 hours	0.33	1 day, 21 hours
The Boxers Area*	0.67	3 days: 12 hours	0.33	3 days: 14 hours	<0.33	NC

† MDO was modelled for this scenario, as comparison of MGO and MDO properties shows that MDO is marginally the more persistent product, and hence the more conservative of the two hydrocarbon types.

** Submerged receptor that has no features above the sea surface. Modelling indicates 'contact' with these receptors occurs when the hydrocarbons pass over the receptor on the sea surface.*

NC: No contact to receptor predicted for specified threshold

Note: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

Source: RPS, 2023

Table 6-9: Spill modelling results – shoreline accumulation from surface release of MGO† from the FPSO (2,418 m^3 released over 1 hour)

Location	Total probability (%) shoreline oil accumulation ≥10 g/m²	Min. arrival time shoreline oil accumulation ≥10 g/m²	Total probability (%) shoreline oil accumulation ≥100 g/m²	Min. arrival time shoreline oil accumulation ≥100 g/m²	Peak volume ashore (m^3)	Max. length of shoreline oiled (km) ≥100 g/m²
Ashmore Reef AMP	0.67	26 days: 1 hour	<0.33	NC	4	NC
Indonesia East and Timor-Leste	2.33	8 days: 18 hours	0.67	10 days: 4 hours	25	5
Minor Indonesian islands	0.33	10 days: 7 hours	<0.33	NC	3	NC
Tiwi Islands	0.33	39 days: 5 hours	<0.33	NC	<1	NC

† MDO was modelled for this scenario, as comparison of MGO and MDO properties shows that MDO is marginally the more persistent product, and hence the more conservative of the two hydrocarbon types.

NC: No contact to receptor predicted for specified threshold

Note: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

Source: RPS, 2023

Table 6-10: Spill modelling results – floating oil from surface release of MDO from a vessel (500 m³ released over 1 hour)

Location	Total contact probability (%) floating oil ≥1 g/m²	Min. arrival time floating oil ≥1 g/m²	Total probability (%) floating oil ≥10 g/m²	Min. arrival time floating oil ≥10 g/m²	Total contact probability (%) floating oil ≥50 g/m²	Min. arrival time floating oil ≥50 g/m²
Afghan Shoal*	0.33	1 day: 17 hours	<0.33	NC	<0.33	NC
Beagle Gulf – Darwin Coast	0.33	3 days: 11 hours	<0.33	NC	<0.33	NC
Shepparton Shoal*	6.00	7 hours	2.00	16 hours	<0.33	NC
NT waters	54.33	1 hour	43.00	1 hour	27.33	1 hour
The Boxers Area*	0.33	2 days: 18 hours	<0.33	NC	<0.33	NC
Tiwi Islands	0.33	2 days: 16 hours	<0.33	NC	<0.33	NC

** Submerged receptor that has no features above the sea surface. Modelling indicates 'contact' with these receptors when the hydrocarbons pass over the receptor on the sea surface.*

NC: No contact to receptor predicted for specified threshold

Note: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

Source: RPS, 2023

Table 6-11: Spill modelling results – shoreline accumulation from surface release of MDO from a vessel (500 m³ released over 1 hour)

Location	Total probability (%) shoreline oil accumulation ≥10 g/m²	Min. arrival time shoreline oil accumulation ≥10 g/m²	Total probability (%) shoreline oil accumulation ≥100 g/m²	Min. arrival time shoreline oil accumulation ≥100 g/m²	Peak volume ashore (m³)	Max. length of shoreline oiled (km) ≥100 g/m²
Beagle Gulf – Darwin Coast	1.00	4 days: 11 hours	<0.33	NC	4	NC
Cape Hotham#	0.33	11 days: 9 hours	<0.33	NC	<1	NC
Joseph Bonaparte Gulf – East Coast	0.33	7 days: 22 hours	<0.33	NC	2	NC
Tiwi Islands	0.33	3 days: 7 hours	0.33	4 days: 3 hours	16	5
Vernon Islands CR	1.67	5 days: 14 hours	<0.33	NC	9	NC

NC: No contact to receptor predicted for specified threshold

Note: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

 # Djukbinj National Park polygon named in the modelling report (RPS, 2023) refers to the area Cape Hotham. There is no hydrocarbon contact with Djukbinj National Park.

Source: RPS, 2023

6.4 Deterministic modelling

Deterministic modelling is a useful tool for response planning. It uses a single spill run from the group of stochastic runs to help understand the likely behaviour and impacts of a single simulation of a worst-case spill scenario. This allows response strategies to be scaled effectively.

For informing and assessing containment and recovery as a response strategy (Section 11), the realisation that resulted in the greatest weekly averaged surface oil with a thickness ≥50 g/m^2 is presented.

For informing shoreline clean-up (Section 15), the realisation that resulted in the maximum volume of shoreline oil ≥100 g/m^2 is presented.

6.4.1 Surface release of condensate from the FPSO (16,700 m^3 released over 1 hour)

A spill simulation commencing during transitional conditions (run 11) resulted in the greatest area of floating oil ≥50 g/m^2. Floating oil exposure ≥50 g/m^2 was predicted on day 0 (maximum of 12 km^2), day 1 (maximum of 18 km^2), day 2 (maximum of 19 km^2), day 3 (maximum of 16 km^2), day 4 (maximum of 12 km^2) and day 5 (maximum of 2 km^2) (RPS, 2023). Following day 5, modelling predicted 0 km^2 of floating oil ≥50 g/m^2.

A spill simulation commencing during transitional conditions (run 45) resulted in the maximum volume of shoreline accumulation ≥100 g/m^2. For this simulation, only Indonesia East and Timor-Leste were predicted to accumulate shoreline oil ≥100 g/m^2 (Table 6-12).

Table 6-12: FPSO storage tank rupture deterministic simulation (run 45), which resulted in the maximum volume of oil ashore ≥100 g/m^2

Receptor	Min. arrival time shoreline oil accumulation ≥100 g/m²	Peak volume ashore (m^3)	Max. length of shoreline oiled (km) ≥100 g/m²
Indonesia East and Timor-Leste	17 days: 10 hours	156	28

Source: RPS, 2023

6.4.2 Surface release of HFO from the offtake tanker (460 m^3 released over 1 hour)

A spill simulation commencing during winter conditions (run 83) resulted in the greatest area of floating oil ≥50 g/m^2. Floating oil exposure ≥50 g/m^2 was predicted on day 0 (maximum of 5 km^2), day 1 (maximum of 4 km^2) and day 2 (maximum of 1 km^2) (RPS, 2023). Following day 2, modelling predicted 0 km^2 of floating oil ≥50 g/m^2.

A spill simulation commencing during transitional conditions (run 99) resulted in the maximum volume of shoreline accumulation ≥100 g/m^2. For this simulation, only Indonesia East and Timor-Leste were predicted to accumulate shoreline oil ≥100 g/m^2 (Table 6-13).

Table 6-13: HFO storage tank rupture deterministic simulation (run 99), which resulted in the maximum volume of oil ashore ≥100 g/m^2

Receptor	Min. arrival time shoreline oil accumulation ≥100 g/m²	Peak volume ashore (m^3)	Max. length of shoreline oiled (km) ≥100 g/m²
Indonesia East and Timor-Leste	9 days: 21 hours	367	20

Source: RPS, 2023

6.4.3 Surface release of MGO from the FPSO (2,418 m^3 released over 1 hour)

A spill simulation commencing during transitional conditions (run 92) resulted in the greatest area of floating oil ≥50 g/m^2. Floating oil exposure ≥50 g/m^2 was predicted on day 0 (maximum of 8 km^2), day 1 (maximum of 8 km^2), day 2 (maximum of 7 km^2) and day 3 (maximum of 4 km^2) (RPS, 2023). Following day 3, modelling predicted 0 km^2 of floating oil ≥50 g/m^2.

A spill simulation commencing during transitional conditions (run 90) resulted in the maximum volume of shoreline accumulation ≥100 g/m^2. For this simulation, only Indonesia East and Timor-Leste were predicted to accumulate shoreline oil ≥100 g/m^2 (Table 6-14).

Table 6-14: MGO storage tank rupture deterministic simulation (run 90), which resulted in the maximum volume of oil ashore ≥100 g/m²

Receptor	Min. arrival time shoreline oil accumulation ≥100 g/m²	Peak volume ashore (m³)	Max. length of shoreline oiled (km) ≥100 g/m²
Indonesia East and Timor-Leste	13 days: 19 hours	25	5

Source: RPS, 2023

6.4.4 Surface release of MDO from a vessel (500 m³ released over 1 hour)

A spill simulation commencing during transitional conditions (run 21) resulted in the greatest area of floating oil ≥50 g/m². Floating oil exposure above 50 g/m² was predicted on day 0 (maximum of 3 km²) (RPS, 2023). Following day 0, modelling predicted 0 km² of floating oil ≥50 g/m².

A spill simulation commencing during winter conditions (run 68) resulted in the maximum volume of shoreline accumulation ≥100 g/m². For this simulation, only the Tiwi Islands were predicted to accumulate shoreline oil ≥100 g/m² (Table 6-15).

Table 6-15: MDO storage tank rupture deterministic simulation (run 68), which resulted in the maximum volume of oil ashore ≥100 g/m²

Receptor	Min. arrival time shoreline oil accumulation ≥100 g/m²	Peak volume ashore (m³)	Max. length of shoreline oiled (km) ≥100 g/m²
Tiwi Islands	4 days: 3 hours	16	5

Source: RPS, 2023

6.5 Evaluation of applicable response strategies

Based on the nature and scale of the spill scenarios outlined in Section 6.1 and spill modelling results (Section 6.3) the following spill response strategies were assessed as potentially applicable for combatting a spill from the Barossa Production Operations activities (Table 6-16).

Note: The information contained in Table 6-16 has been developed by Santos for preparedness purposes. Santos may not be the Control Agency or Lead IMT for implementing a spill response. For example, for Level 2/3 spills within or entering Territory waters, the NT Control Agency (or for State waters, WA DoT) will ultimately determine the strategies and controls implemented for most Territory/State waters activities, with Santos providing resources and planning assistance.

Table 6-16: Evaluation of applicable response strategies

OSR strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy				Considerations
		Barossa Condensate (subsea release from a production well)	Barossa Condensate (surface release form the FPSO)	HFO (surface release from the offtake tanker)	MGO / MDO (surface release of MGO from the FPSO / MDO from a vessel)	
Source control	Spill kits	×	×	✓ 1	✓ 1	**HFO and MGO / MDO spills** Relevant for containing spills that may arise onboard a vessel.
	Secondary containment	×	×	✓ 1	✓ 1	**HFO and MGO / MDO spills** Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment onboard a vessel. Bunded areas will contain hydrocarbons reducing the potential for a spill escaping to marine waters. Where applicable, open deck drainage will be closed to prevent hydrocarbons draining into the marine environment.
	SOPEP	×	✓ 1	✓ 1	✓ 1	MARPOL requirement for applicable vessels. If a vessel hydrocarbon storage tank is ruptured, applicable strategies for reducing the volume of hydrocarbon releases will be documented in the vessel SOPEP. This may include securing fuel via transfer to another storage area onboard the vessel, transfer to another vessel, or by pumping water into the affected tank to create a water cushion (tank water bottom). Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will aim to minimise the volume of fuel spilled.
	Emergency shutdown device (ESD)	✓ 1	✓ 1	×	×	**Barossa Condensate – surface release from the FPSO** ESD systems are provided on the FPSO to protect personnel, the environment and equipment from the effects of accidental or uncontrolled hydrocarbon leakages, fires or other incidents requiring emergency shutdown of the FPSO. A FPSO spill involving a vessel collision and loss of inventory may result in a 'High-Level Emergency Shutdown' (Level 1) or 'Abandon FPSO Shutdown' (Level 0).
	Surface well-kill	×	×	×	×	Not applicable - all wells are subsea.
	Capping stack	×	×	×	×	Deploying a capping stack under the credible production well-leak scenarios outlined in the EP would not be an effective method of source control.
	Relief well drilling	✓ 1	×	×	×	Relief well drilling is the primary strategy to control a well leak that cannot be controlled via a controlled shutdown and/or on-site systems. To be conducted as per the Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001).
In situ burning	Controlled burning of oil spill	×	×	×	×	**Subsea release from a production well / surface release from the FPSO – Barossa Condensate** Not applicable to wells with light hydrocarbons due to safety hazards. **Surface release from the offtake tanker – HFO** In situ burning is typically less effective on heavier hydrocarbons (Faksness et al., 2022). It has limited effectiveness on fresh HFO, and even less effectiveness on weathered HFO. There are no trained personnel or fireproof booms to facilitate in situ burning in Australia for it to be considered a feasible response strategy. Use of this response would only be through using

OSR strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy				Considerations
		Barossa Condensate (subsea release from a production well)	Barossa Condensate (surface release form the FPSO)	HFO (surface release from the offtake tanker)	MGO / MDO (surface release of MGO from the FPSO / MDO from a vessel)	
						trained international resources, by which time the product would be too weathered for in situ burning to be effective. **Surface release of MGO from the FPSO / MDO from a vessel** Not applicable to MGO / MDO spills due to inability to contain MGO / MDO making it very difficult to maintain necessary slick thickness for ignition and sustained burning. In addition, in situ burning is not normally considered an acceptable response strategy due to the atmospheric emissions created.
Monitor and evaluate plan	Vessel surveillance	✓ 1	✓ 1	✓ 1	✓ 1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). Informs implementation of other response strategies. Vessel personnel may not be trained observers. Vessel observers on leaking vessel may not have capacity to observe oil during emergency response procedure. implementation. Constrained to daylight. Limited to visual range from the vessel. Limited capacity to evaluate possible interactions with sensitive receptors.
	Aerial surveillance	✓ 1	✓ 1	✓ 1	✓ 1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). May identify environmental sensitivities impacted or at risk of impact (e.g. seabird aggregations, other users such as fishers). Provides information on the effectiveness of response strategies. Informs implementation of other response strategies.
	Tracking buoys	×	✓ 1	✓ 1	✓ 1	Can be implemented rapidly. Can provide indication of near-surface entrained/dissolved hydrocarbons (most other monitor and evaluate techniques rely on the hydrocarbon being on the surface or shoreline).
	Trajectory modelling	✓ 1	✓ 1	✓ 1	✓ 1	Can be implemented rapidly. Predictive – estimates where the oil may go, which can be used to prepare and implement other responses. No additional field personnel required. Not constrained by weather conditions. Can predict floating, entrained, dissolved and stranded hydrocarbon fractions. May not be accurate. Requires in-field calibration.
	Satellite imagery	✓ 1	✓ 1	✓ 1	✓ 1	Can work under a large range of weather conditions (e.g. night-time, cloud cover, etc.).

OSR strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy				Considerations
		Barossa Condensate (subsea release from a production well)	Barossa Condensate (surface release form the FPSO)	HFO (surface release from the offtake tanker)	MGO / MDO (surface release of MGO from the FPSO / MDO from a vessel)	
						Mobilisation restricted to image availability. Requires processing. May return false positives.
Chemical dispersion	Vessel application	×	×	✓ 2	×	**Barossa Condensate and MGO / MDO**
	Aerial application	×	×	✓ 2	×	Neither Barossa Condensate nor MGO / MDO are persistent hydrocarbons—both have high natural spreading, dispersion and evaporation rates in the marine environment. Surface chemical dispersants are most effective on hydrocarbons that are 50–100 g/m^2 thick on the sea surface. EMSA (2010) recommends thin layers of spilled hydrocarbons should not be treated with dispersant, including surface slicks with BAOAC 1–3. Barossa Condensate and MGO / MDO would rapidly spread and thin out on the sea surface, so are unlikely to reach this required thickness. Chemical dispersant application is not recommended as a beneficial option because: • It has a low additional benefit of increasing the dispersal rate of the Barossa Condensate or MGO / MDO spills. • These hydrocarbons have high natural evaporation rates (Barossa Condensate – 79% over 24 hours, MGO / MDO – 95% over several days). • It introduces more chemicals into the marine environment for limited environmental benefit, whilst potentially increasing localised toxicity in the water column. • The low volatile and persistent components contained within Barossa Condensate and MGO / MDO will have a strong tendency to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves but can refloat to the surface if these energies abate; this will also lower the effectiveness of dispersant. This will leave only a small proportion of floating oil on the water surface for both hydrocarbon types. **Surface release from the offtake tanker - HFO** HFO spills are only a potential risk when offtakes are scheduled. Although deterministic results from oil spill modelling indicated no area of exposure of floating oil ≥50 g/m^2 beyond day 2 (run 83), surface dispersant application was selected as a secondary strategy for HFO. Deterministic modelling (Section 6.4) indicates the floating hydrocarbons ≥50 g/m^2 drop below 1 km^2 after day 2, but it is possible that windrows of HFO will still exist and may be successfully treated with dispersant. Some dispersants are effective on different HFO, although effectiveness rapidly decreases as the product weathers. Testing conducted by the New Zealand Maritime Safety Authority indicated that Corexit 9500 and Slickgone EW were most effective on a range of intermediate fuel oils (IFOs) and HFOs (Stevens and Roberts, 2003). Due to the persistent and viscous nature of this product, it is expected that repeated application or increased dispersant dosage ratios will be required to get HFO to respond to dispersant. Consideration should be given to any impacts this may cause on subsurface receptors and the location of spraying. Due to the limited window of opportunity and limited effectiveness of

OSR strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy				Considerations
		Barossa Condensate (subsea release from a production well)	Barossa Condensate (surface release form the FPSO)	HFO (surface release from the offtake tanker)	MGO / MDO (surface release of MGO from the FPSO / MDO from a vessel)	
						dispersants on this product type, chemical dispersant application on HFO is considered a secondary response strategy and would only be used if a NEBA indicated a net environmental benefit.
	Subsea dispersant injection (SSDI)	×	×	×	×	SSDI is used to reduce impacts to ecological and socioeconomic receptors by reducing the oil released subsea from reaching the sea surface by dispersing the oil into the water column. SSDI is also used to reduce volatile organic compounds (VOCs) near the spill site, providing a health and safety benefit to responders (IPIECA, 2015). Spill modelling predicts no floating oil exposure above any threshold for any well-leak scenario (subsea release from a production well), therefore SSDI is not required for reducing floating oil exposure. In addition, the low flow rates of a well-leak scenario would not be suitable for SSDI application as insufficient mixing would occur.
Offshore containment and recovery	Use offshore booms/ skimmers or other collection techniques deployed from vessel/s to contain and collect oil	×	×	✓ 2	×	**Subsea release from a production well – Barossa Condensate** Modelling indicated no probability of floating hydrocarbon exposure at any threshold. **Surface release from the FPSO – Barossa Condensate** Barossa Condensate is a low viscosity, rapidly weathering hydrocarbon. Assay results indicate up to 79% of the hydrocarbon would evaporate within 24 hours, depending on weather conditions and sea state. Deterministic results (Section 6.4) for the surface release of condensate from the FPSO (16,700 m^3 released over 1 hour) predicted floating oil could still exceed 50 g/m^2 by day 5, noting that the weather conditions on this day were predicted to be very calm. Following day 5, modelling predicted no areas of floating oil exceeding 50 g/m^2. Under typical sea state conditions experienced in the region, this hydrocarbon is expected to weather rapidly, spread to a thin film and make recovery via skimmers ineffective. As such, containment and recovery is considered unsuitable for Barossa Condensate. The ability to contain and recover rapidly weathering hydrocarbons on the sea surface is extremely limited due the very low viscosity of Barossa Condensate. **Surface release from the offtake tanker - HFO** HFO spills are only a potential risk when offtakes are scheduled. Although deterministic results from oil spill modelling indicated no area of exposure of floating oil >50 g/m^2 beyond day 2 (run 83), containment and recovery was selected as a secondary strategy because containment and recovery packages may be able to arrive at the spill location within 60–72 hours and recover isolated windows of oil. Deterministic modelling (Section 6.4) indicates the floating hydrocarbons ≥50 g/m^2 drop below 1 km^2 after day 2, but it is possible that windows of HFO may still exist and can be corralled to sufficient thicknesses to be recovered. The drawback of containment and recovery includes the production of significant volumes of waste due to the potential collection of water with floating oil; however, this can be mitigated to some extent if decanting is permitted. If metocean conditions are favourable, this strategy would remove floating hydrocarbons from the environment. **Surface release of MGO from the FPSO / MDO from a vessel**

OSR strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy				Considerations
		Barossa Condensate (subsea release from a production well)	Barossa Condensate (surface release form the FPSO)	HFO (surface release from the offtake tanker)	MGO / MDO (surface release of MGO from the FPSO / MDO from a vessel)	
						Not suitable for MGO / MDO given its rapid weathering nature. MGO / MDO spreads quickly to a thin film, making recovery via skimmers difficult and ineffective. The ability to contain and recover rapidly weathering hydrocarbons on the sea surface is extremely limited due the very low viscosity of MGO / MDO.
Mechanical dispersion	Vessel propeller washing	×	✓ 2	×	✓ 2	**Surface release from the FPSO - Barossa Condensate and MGO / MDO** Safety is a key factor and slicks with potential for high VOC emissions are not suitable for mechanical dispersion. Mechanical dispersion may be applicable for the localised entrainment of surface oil but is not considered to have a significant effect on removing oil from the surface. Mechanical dispersion will entrain surface oil into the top layer of the water column. The aim of this tactic is to reduce the concentration of oil floating at the surface that could potentially contact receptors at the sea surface (e.g. seabirds) or shoreline receptors (e.g. mangroves). Once dispersed in the water column, the smaller droplet sizes enhance the biodegradation process. Barossa Condensate and MGO / MDO are light hydrocarbons that can be easily dispersed into the water column by running vessels through the plume and using propeller turbulence to break up the slick. Mechanical dispersion may be considered for targeted small breakaway patches of crude oil but may have limited effectiveness. The potential disadvantage of mechanical dispersion is that it could temporarily increase the concentration of entrained and dissolved oil near submerged shallow water receptors (e.g. corals, seagrasses, macroalgae). This is most likely in shallow water a few metres deep. The suitability of mechanical dispersion as a response measure would consider the prevailing environmental conditions (it mimics the action of wave-induced entrained oil so is most beneficial in calm conditions) and the type, proximity and depth (as applicable) of sensitivities in the area. Mechanical dispersion will be considered for petroleum activity sourced spills at the discretion of the OSC/ Vessel Master/ IMT or by the relevant Control Agency. It is unlikely that vessels would be specifically allocated for mechanical dispersion but support vessels in the field undertaking primary strategies may be used opportunistically. **Surface release from the offtake tanker - HFO** Mechanical dispersion is not considered to be effective on HFO because this oil is persistent and is resistant to entrainment.
Protection and deflection	Booming in nearshore waters and at shorelines	×	✓ 2	✓ 1	✓ 2	**Subsea release of condensate from a production well – Barossa Condensate** Modelling indicates no probability of shoreline accumulation at any exposure value. **Surface release from the FPSO – Barossa Condensate and MGO / MDO** Considered if operational monitoring shows or predicts contact with sensitive shorelines. Modelling indicates very low probabilities of shoreline accumulation ≥100 g/m^2 for all scenarios (surface release of condensate from the FPSO [16,700 m^3 released over 1 hour] = <0.7%;

OSR strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy				Considerations
		Barossa Condensate (subsea release from a production well)	Barossa Condensate (surface release form the FPSO)	HFO (surface release from the offtake tanker)	MGO / MDO (surface release of MGO from the FPSO / MDO from a vessel)	
						surface release of MGO from the FPSO [2,418 m^3 released over 1 hour], = <0.7%; surface release of MDO from a vessel [500 m^3 released over 1 hour] =<0.33%). Shoreline accumulation is predicted to be low for the MGO / MDO scenarios (surface release of MGO from the FPSO [2,418 m^3 released over 1 hour] = 25 m^3; surface release of MDO from a vessel [500 m^3 released over 1 hour] = 16 m^3 in the worst-case replicate simulations). Shoreline protection and deflection activities can result in physical disturbance to intertidal and shoreline habitats. Given the high rates of natural dispersion and biodegradation of Barossa Condensate and MGO / MDO, it would be better to focus on priority areas for protection. This strategy is considered to be a secondary response strategy where it is safe and practical to implement and where priority protection areas are at risk of impact from hydrocarbons. **Surface release from the offtake tanker - HFO** Stochastic modelling predicts low probabilities of shoreline accumulation (<1.7% of ≥100 g/m^2), but predicted volumes for the worst-case replicate simulation are high (298 m^3 at Cobourg Peninsula – Nhulunbuy; 376 m^3 at Indonesia East and Timor-Leste). HFO has the potential to generate considerable volumes of waste when it contacts shorelines due to its emulsification and bulking potential, making shoreline protection important. The effectiveness of this response will depend on local bathymetry, sea state, currents, tidal variations and wind conditions at the time of implementation. It is typically more effective in areas with low to moderate tidal ranges on low-energy coastline types such as sandy beaches. Moderate to high tidal ranges generally include stronger currents and larger/longer intertidal areas that make it less effective and more difficult to keep booms in place. Protection and deflection is feasible in locations where access to the coastline allows vehicles and vessels to undertake operations. Activities would focus on areas of high protection value in low-energy environments based on real-time operational surveillance, provided the environmental and metocean conditions are favourable for an effective implementation. Consequently, this strategy may not be applicable across all areas or receptors identified as priorities for protection.
Shoreline clean-up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	×	✓ 2	✓ 1	✓ 2	**Subsea release from a production well – Barossa Condensate** Modelling indicates no probability of shoreline accumulation at any exposure value. **Surface release from the FPSO – Barossa Condensate and MGO / MDO** Considered if operational monitoring shows or predicts contact with sensitive shorelines. Modelling indicates very low probabilities of shoreline accumulation ≥100 g/m^2 for all scenarios (surface release of condensate from the FPSO [16,700 m^3 released over 1 hour] = <0.7%; surface release of MGO from the FPSO [2,418 m^3 released over 1 hour] = <0.7%; surface release of MDO from a vessel [500 m^3 released over 1 hour] =<0.33%). Shoreline accumulation is predicted to be low for the MGO / MDO scenarios (surface release of MGO from the FPSO [2,418 m^3 released over 1 hour] = 25 m^3; surface release of MDO from a vessel [500 m^3 released over 1 hour] = 16 m^3 in the worst-case replicate simulations), and moderate for surface release of condensate from the FPSO (16,700 m^3 released over 1 hour) (156 m^3).

OSR strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy				Considerations
		Barossa Condensate (subsea release from a production well)	Barossa Condensate (surface release form the FPSO)	HFO (surface release from the offtake tanker)	MGO / MDO (surface release of MGO from the FPSO / MDO from a vessel)	
						Shoreline clean-up activities can result in physical disturbance to shoreline habitats. Given the high rates of natural biodegradation of MGO / MDO and Barossa Condensate, it would be better to focus on high priority areas for clean-up. This strategy is considered to be a secondary response strategy for MGO / MDO and Barossa Condensate where it is safe and practical to implement and where Protection Priority Areas (PPAs) are at risk of impact. **Surface release from the offtake tanker – HFO** Stochastic modelling predicts low probabilities of shoreline accumulation (<1.7% of ≥100 g/m^2), but predicted volumes for the worst-case replicate simulation are moderately high (298 m^3 at Cobourg Peninsula – Nhulunbuy; 376 m^3 at Indonesia East and Timor-Leste). HFO has the potential to generate considerable volumes of waste due to its emulsification and bulking potential. Shoreline clean-up can reduce stranded oil on shorelines and/or reduce remobilisation of oil. However, this response has potential to cause more impacts than benefits, especially if oiling is light. Shoreline assessments as part of operational monitoring provide site-specific guidance on the applicability and likely benefits of different clean-up techniques. Intrusive activities such as physical removal of waste using manual labour or mechanical aids require careful site-specific planning to reduce secondary impacts of habitat disturbance, erosion and spreading oil beyond shorelines (i.e. secondary contamination). Secondary impacts can be minimised by using trained personnel to lead operations. Logistically, clean-up operations will require site access, decontamination, waste storage, personal protective equipment (PPE), catering and transport services to support personnel working on shorelines. Flushing may be considered if the oil enters high priority/slow recovery habitats such as mangroves. Natural dispersion will occur as the hydrocarbon is remobilised from rock shelves and hard substrates, while residual hydrocarbons will biodegrade.
OWR	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation	×	✓ 1	✓ 1	✓ 1	**Subsea release from a production well – Barossa Condensate** Modelling indicates no probability of floating hydrocarbon exposure at any threshold and no shoreline accumulation, hence there is no risk to wildlife from physical coating. Given the location and nature of the subsea release scenario, and the high mobility of wildlife, it is unlikely that wildlife would be at risk from the surface inhalation of volatile fumes. **Surface release from the FPSO – Barossa Condensate and MGO / MDO; and surface release from the offtake tanker – HFO** Can be used to deter and protect wildlife from contact with oil. Mainly applicable for marine and coastal fauna (e.g. birds) where oil is present at the sea surface or accumulated at coastlines. Surveillance can be carried out as a part of the fauna-specific operational monitoring. Wildlife may become desensitised to hazing method. Hazing may affect animals (e.g. stress, disturb important behaviours such as nesting or foraging).

OSR strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy				Considerations
		Barossa Condensate (subsea release from a production well)	Barossa Condensate (surface release form the FPSO)	HFO (surface release from the offtake tanker)	MGO / MDO (surface release of MGO from the FPSO / MDO from a vessel)	
						Permitting requirements for hazing and pre-emptive capture.
OSM	Monitor the effectiveness and potential impacts of response strategies; and monitor environmental receptors to determine the level of impact from the oil spill and associated response activities that is sufficient to inform any remediation activities	✓ 1	✓ 1	✓ 1	✓ 1	Operational monitoring activities include: • hydrocarbon properties and weathering behaviour • water and sediment quality assessment • chemical dispersant effectiveness and fate assessment • rapid marine fauna surveillance • shoreline clean-up assessment Scientific monitoring activities include: • water and sediment quality assessment • intertidal and coastal habitat assessment • seabirds and shorebirds assessment • marine megafauna assessment • benthic habitat assessment • marine fish and elasmobranch assemblages assessment • fisheries assessment • heritage features assessment • social impact assessment. The type and extent of OSM will depend upon the nature and scale of hydrocarbon contact to sensitive receptor locations. Pre-defined initiation criteria exist for OSM plans.

6.6 Identification of priority protection areas and initial response priorities

Combined spill modelling results were used to predict the Environment that may be Affected (EMBA) for Barossa Production Operations activities (refer to Section 3.1.1 of the Barossa Production Operations EP [BAA-200 0637]). The EMBA is the largest area within which effects from hydrocarbon spills associated with this activity could extend. Within the EMBA, Santos has determined Hot Spots (key areas of high environmental value [HEV] that have the greatest potential to be impacted by a Barossa Production Operations spill) for which detailed oil spill risk assessment has been conducted (refer to Section 7.7.5 of the Barossa Production Operations EP).

From these Hot Spot areas, priority protection areas (PPAs) have been identified. In the spill response preparedness process, it is not necessary for all Hot Spots to have detailed planning. For example, wholly submerged Hot Spots may only be contacted by entrained oil, and the response would be largely to implement monitoring to determine impact and recovery. Determining monitoring priority areas is detailed in the Northern Australia OSM-BIP (7715-650-ERP-0003).

Hot Spots with emergent features (i.e. coastal areas and islands) are considered during the PPA selection process, as they are the receptors that would be targeted by nearshore spill response operations, such as protection and deflection and shoreline clean-up.

Santos has applied a conservative approach to identifying initial PPAs for spills associated with Barossa Production Operations activities—no shoreline receptors are predicted to be contacted at the moderate threshold (≥100 g/m^2) and ≥5% probability for any scenario. Therefore, these criteria were used to identify PPAs in this OPEP:

- contacted at the low exposure threshold for shoreline accumulation (≥10 g/m^2)
- contacted above the lowest probability predicted by spill modelling results (≥0.33%)
- minimum arrival time of predicted shoreline accumulation (<14 days).

Table 6-17 details the Hot Spots and PPAs from the list of contacted receptors from all scenarios. Rationale is included in the table when a Hot Spot is included, or not included, as a PPA.

Table 6-17: Determination and rationale for Hot Spots and PPAs for Barossa Production Operations

Hot spot	Type	HEV ranking	Hot spot	PPA	Rationale
Ashmore Reef AMP	Emergent	2	Y	N	Time to contact >14 days
Beagle Gulf–Darwin Coast	Emergent	4	Y	Y	Time to contact <14 days
Cobourg Peninsula-Nhulunbuy	Emergent	3	Y	N	Time to contact >14 days
Cape Hotham	Emergent	5	Y	Y	Time to contact <14 days
Indonesia East – Timor-Leste	Emergent	5	Y	Y	Time to contact <14 days High shoreline accumulation volumes
Joseph Bonaparte Gulf – East Coast	Emergent	4	Y	Y	Time to contact <14 days
Minor Indonesian islands	Emergent	5	Y	Y	Time to contact <14 days High shoreline accumulation volumes
Tiwi Islands	Emergent	5	Y	Y	Time to contact <14 days
Van Diemen Gulf Coast	Emergent	1	Y	N	Time to contact >14 days
Vernon Islands CR	Emergent	5	Y	Y	Time to contact <14 days

Table 6-18 and Table 6-19 list the key sensitivities and associated locations within the PPAs identified for each worst-case spill scenario. The ranking of these sensitivities (also referred to as receptors) are listed—these are consistent with the rankings in Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 1: Kimberley (Advisian, 2018). The initial response priority in Table 6-18 and Table 6-19 was calculated using a combination of sensitivities, their associated rankings, and the modelled maximum total volumes ashore and minimum time to shoreline contact. This information is designed to aid decision-making in the preliminary stages of the response operation so that initial resources are used for best effect. Note: The PPAs for response also correspond with the wildlife PPAs presented in Section 16.2, with further detail on the species that may be present and key locations provided in Table 16-3.

Table 6-18: Initial response priorities – Barossa Production Operations –Surface release of condensate from the FPSO (16,700 m^3 released over 1 hour);, surface release of HFO from the offtake tanker (460 m^3 released over 1 hour); and surface release of MGO from the FPSO (2,418 m^3 released over 1 hour)

Protection priority area	Key sensitivities	WA DoT ranking (floating oil)[26]	WA DoT ranking (dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Initial response priority
Indonesia East and Timor-Leste (Including Timor; Savu, Rote)	Seagrass	3	3	Savu South coast of Timor-Leste	-	Surface release of condensate from the FPSO (16,700 m^3): 156 Surface release of HFO from the offtake tanker (460 m^3): 367 Surface release of MGO from the FPSO (2,418 m^3): 25	Surface release of condensate from the FPSO (16,700 m^3): 9 days: 22 hours Surface release of HFO from the offtake tanker (460 m^3): 9 days: 4 hours Surface release of MGO from the FPSO (2,418 m^3): 8 days: 18 hours	Medium
	Coral • Coral triangle	3	4	-	-			Low
	Mangroves	3	3	Maubesi Mangrove Forest Nature Reserve	-			Medium
	Saltwater Crocodile	2	1	Widespread	-			Low
	Turtles • Green • Olive Ridley • Hawksbill • Leatherback • Loggerhead	4	3	Refer to Table 16-3	-			High
	Marine mammals • Dugong • Pygmy Blue Whale • Sperm whale • Orca • High abundance and diversity of cetaceans	4	3	Refer to Table 16-3	Pygmy blue whales: June–September			Low
	Shorebirds	3	2	Refer to Table 16-3	August–May			Medium
	Traditional and commercial fishing	3	2	-	-			Low

[26] *Adapted from Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 1: Kimberley (Advisian, 2018).*

Protection priority area	Key sensitivities	WA DoT ranking (floating oil)[26]	WA DoT ranking (dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Initial response priority
	Seaweed farming	3	2	-	-			Low
Minor Indonesian islands (Maluku Province)	Coral • Coral triangle	3	4	-	-	Surface release of condensate from the FPSO (16,700 m^3): 41 Surface release of HFO from the offtake tanker (460 m^3): 174 Surface release of MGO from the FPSO (2,418 m^3): 3	Surface release of condensate from the FPSO (16,700 m^3): 12 days: 7 hours Surface release of HFO from the offtake tanker (460 m^3): 12 days: 13 hours Surface release of MGO from the FPSO (2,418 m^3): 10 days: 7 hours	Low
	Turtles • Green • Hawksbill	3	2	Refer to Table 16-3	-			High
	Marine mammals • Dugong • Pygmy Blue Whale • High abundance and diversity of cetaceans	4	3	Refer to Table 16-3	Pygmy Blue Whales: June–September			Low
	Traditional and commercial fishing	3	2	-	-			Low

Table 6-19: Initial response priorities – Surface release of MDO from a vessel (500 m^3 released over 1 hour)

Protection priority area	Key sensitivities	WA DoT ranking (floating oil)[27]	WA DoT ranking (dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Initial response priority
Beagle Gulf – Darwin Coast	Mangroves	3	3	Gunn Point Tree Point Mickett Creek Buffalo Creek Charles Darwin National Park Wickham Point	N/A	4	4 days: 11 hours	Medium

[27] *Adapted from Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 1: Kimberley (Advisian, 2018).*

Protection priority area	Key sensitivities	WA DoT ranking (floating oil)[27]	WA DoT ranking (dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Initial response priority
	Seagrass	3	3	Casuarina Coastal Reserve Mindil Beach Fannie Bay West Arm	-			Medium
	Wetlands of National Importance	4	4	Port Darwin and Shoal Bay – Mickett Creek	-			High
	Saltwater Crocodile	2	1	widespread	-			Low
	Shorebirds	3	2	Refer to Table 16-3	-			Medium
	Marine mammal • Australian Snubfin Dolphin • Indo-Pacific Humpback Dolphin • Indo-Pacific Bottlenose Dolphin	4	3	-	-			Low
	Turtles • Flatback • Olive Ridley	4	3	Refer to Table 16-3	-			High
	Cultural heritage	3	3	-	-			Medium
	Recreational fishing, boating and tourism	3	2	-	-			Low
	Shipwrecks	1	1	-	-			Low
Cape Hotham	Shorebirds	3	2	Refer to Table 16-3	-	<1	11 days: 9 hours	Medium
	Marine mammal • Dugong • Australian Snubfin Dolphin	3	2	-	-			Low

Protection priority area	Key sensitivities	WA DoT ranking (floating oil)[27]	WA DoT ranking (dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Initial response priority
	• Indo-Pacific Humpback Dolphin • Indo-Pacific Bottlenose Dolphin							
	Saltwater Crocodile	2	1	widespread	-			Low
	Cultural heritage	3	3	-	-			Medium
Joseph Bonaparte Gulf – East Coast	Mangroves	3	3	widespread	N/A	2	7 days:22 hours	Medium
	Wetlands of National Significance	4	4	Finniss floodplain estuary system	-			High
	Birds • Migratory shorebirds	4	3	Refer to Table 16-3	-			Medium
	Birds • Seabirds			Refer to Table 16-3	-			
	Marine mammal • Dugong • Australian Snubfin Dolphin • Indo-Pacific Humpback Dolphin • Indo-Pacific Bottlenose Dolphin	3	2	-	-			Low
	Saltwater crocodile	2	1	widespread	-			Low
	Turtles • Green • Olive Ridley • Flatback	4	3	Refer to Table 16-3	-			High
Tiwi Islands	Mangroves	3	3	widespread	N/A	16	3 days: 7 hours	Medium
	Turtles • Flatback • Olive Ridley	4	3	Refer to Table 16-3	-			High

Protection priority area	Key sensitivities	WA DoT ranking (floating oil)[27]	WA DoT ranking (dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Initial response priority
	Saltwater Crocodile	2	1	widespread	-			Low
	Marine Mammals • Australian Snubfin Dolphin • Spotted Dolphin • Orca • Spotted Bottlenose Dolphin • Australian Humpback Dolphin • Humpback Whale • Common Dolphin • Risso's Dolphin • Bottlenose Dolphin • Indian Ocean Bottlenose Dolphin • Blue Whale • Bryde's Whale • Dugong	3	2	-	Peak between June – August			Low
	Birds The Tiwi Islands support exceptionally high densities of the vulnerable Red Goshawk. They also support many migratory shorebirds including more than 1% of the world's Great Knots.	3	2	Refer to Table 16-3	Peak between June – August			Medium
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning – March & October			Low
	Socioeconomic • Tourism – charter boats, diving and snorkelling • Recreational fishing	1	1	N/A	Tourism: April to August			Low

Protection priority area	Key sensitivities	WA DoT ranking (floating oil)[27]	WA DoT ranking (dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Initial response priority
	Cultural heritage	3	3	-	-			Medium
Vernon Islands CR	Mangroves	3	3	widespread	N/A	9	5 days: 14 hours	Medium
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning: March & October			Low
	Saltwater Crocodile	2	1	widespread	-			Low
	Shorebirds and seabirds (low abundance as island largely covered in mangroves)	2	1	-	-			Low
	Marine mammal • Dugong • Australian Snubfin Dolphin • Indo-Pacific Humpback Dolphin • Indo-Pacific Bottlenose Dolphin	3	2	-	-			Low
	Cultural heritage	3	3	-	-			Medium
	Diving sites	1	1	Blue Holes	-			Low

6.6.1 Tactical response plans for priority protection areas

Santos Tactical Response Plans (TRPs) are in place for certain receptors (Table 6-20), identifying suitable response strategies, equipment requirements, relevant environmental information, and access and permit requirements. TRPs are to be used by the IMT for first-strike and ongoing activities and to help inform the appropriate responses for inclusion in an IAP.

Not all PPAs require TRPs in place. The requirement for a TRP considers the hydrocarbon type and predicted time to contact to a PPA from floating or accumulated hydrocarbons ≥100 g/m^2 in <10 days. Ten days allows 2 days to get services procured, 6 days to draft the TRP, and 2 days to implement. The Sensitivity Ranking (HEV and WA DoT), and accessibility (i.e. on mainland compared to a remote island location) are also considered.

A TRP will also be considered if the impact from hydrocarbons is likely to be considerable (high shoreline accumulation and/or large floating oil contact). Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, NTOWRP and WAMOPRA. Additionally, TRPs for contacted receptors will be sought from other operators where possible.

Table 6-20: Tactical response plans for priority protection areas

PPA	TRP evaluation	Existing TRP
Tiwi Islands	Yes – potential accumulation and contact time <10 days. A TRP will be prepared for Tiwi Islands before operations commence.	To be developed before operations commence

6.7 Net environmental benefit analysis

The IMT uses a NEBA, also referred to as a spill impact mitigation assessment (SIMA), to inform the incident action planning process (Section 8), so the most effective response strategies with the least detrimental environmental impacts can be identified, documented and implemented.

The Environment Unit Leader will use the information in Section 6.6 to identify and prioritise initial response priorities and apply the NEBA to identify which response strategies are preferred for the situation, oil type and behaviour, environmental conditions, plume direction and priorities for protection.

As a component of the incident action planning process, NEBA is conducted by the Control Agency with responsibility for the spill response activity. If different activities are controlled by different IMTs, as in a cross-jurisdictional response between Santos and WA DoT, consultation will be required during the NEBA process to ensure consistency in the sensitivities prioritised for response across the Control Agencies.

A strategic NEBA has been developed for all response strategies identified as applicable to the spill scenarios, with the benefit or potential impact to each sensitivity identified (refer to Table 6-21 to Table 6-23).

In the event of a spill, NEBA is applied with supporting information collected as part of the Operational Monitoring Plan (OMP; Section 10) to:

- identify sensitivities within the area potentially affected by a spill at that time of the year (Note: The sensitivity of some key receptors, such as birdlife and turtles, varies seasonally)
- help prioritise and allocate resources to sensitivities with a higher protection and response priority (Table 6-18 and Table 6-19)
- help determine appropriate response strategies using real-time metocean conditions, oil spill tracking and fate modelling.

When a spill occurs, NEBA is applied to the current situation, or operationalised. Operational NEBA templates are filed within the Environment Unit Leader folder on the Santos ER SharePoint site. To complete the operational NEBA:

- record all ecological and socioeconomic sensitivities identified within the spill trajectory area
- assess the potential effects of response strategies on each sensitivity in terms of their benefit or otherwise to the socioeconomic sensitivities
- consider all people involved and data inputs for the analysis.

The Operational NEBA Form documents the decisions behind the recommendation to the Incident Commander on which resources at risk to prioritise, and the positives and negatives of response strategies to deploy. The operational NEBA provides guidance to the IAPs and is revisited each operational period.

Table 6-21: Strategic NEBA matrix – Barossa Production Operations – Surface release of condensate from the FPSO (16,700 m³ released over 1 hour) and surface release of MGO from the FPSO (2,418 m³ released over 1 hour)

Priority protection area	No controls	Source control	Monitor and evaluate	Mechanical dispersion	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Indonesia East and Timor-Leste (Including Timor; Savu, Rote)								
Seagrass							N/A	
Coral • Coral triangle					N/A	N/A	N/A	
Mangroves							N/A	
Saltwater Crocodile								
Turtles • Green • Olive Ridley • Hawksbill • Leatherback • Loggerhead								
Marine mammals • Dugong • Pygmy Blue Whale • Sperm whale • Orca • High abundance and diversity of cetaceans								
Shorebirds								
Traditional and commercial fishing							N/A	
Seaweed farming							N/A	
Minor Indonesian islands (Maluku Province)								
Coral • Coral triangle					N/A	N/A	N/A	

Priority protection area	No controls	Source control	Monitor and evaluate	Mechanical dispersion	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Turtles • Green • Hawksbill								
Marine mammals • Dugong • Pygmy Blue Whale • High abundance and diversity of cetaceans								
Traditional and commercial fishing							N/A	
Key:								
	Beneficial impact							
	Possible beneficial impact depending on the situation (e.g. timeframes and metocean conditions)							
	Negative impact							
N/A	Not applicable for the environmental value or not applicable for hydrocarbon type							

Table 6-22: Strategic NEBA matrix – Barossa Production Operations – Surface release of HFO from the offtake tanker (460 m^3 released over 1 hour)

Priority protection area	No controls	Source control	Monitor and evaluate	Surface dispersant	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Indonesia East and Timor-Leste (including Timor; Savu, Rote)								
Seagrass							N/A	
Coral • Coral triangle					N/A	N/A	N/A	
Mangroves								
Saltwater Crocodile								

Priority protection area	No controls	Source control	Monitor and evaluate	Surface dispersant	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Turtles • Green • Olive Ridley • Hawksbill • Leatherback • Loggerhead								
Marine mammals • Dugong • Pygmy Blue Whale • Sperm whale • Orca • High abundance and diversity of cetaceans								
Shorebirds								
Traditional and commercial fishing							N/A	
Seaweed farming								
Minor Indonesian islands (Maluku Province)								
Coral • Coral triangle					N/A	N/A	N/A	
Turtles • Green turtle • Hawksbill								
Marine mammals • Dugong • Pygmy Blue Whale • High abundance and diversity of cetaceans								
Traditional and commercial fishing							N/A	

Priority protection area	No controls	Source control	Monitor and evaluate	Surface dispersant	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Key:								
	Beneficial impact							
	Possible beneficial impact depending on the situation (e.g. timeframes and metocean conditions)							
	Negative impact							
N/A	Not applicable for the environmental value or not applicable for hydrocarbon type							

Table 6-23: Strategic NEBA matrix – Barossa Production Operations – Surface release of MDO from a vessel (500 m^3 released over 1 hour)

Priority protection area	No controls	Source control	Monitor and evaluate	Mechanical dispersion	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Beagle Gulf – Darwin Coast								
Mangroves								
Seagrass							N/A	
Wetlands of National Importance								
Saltwater Crocodile								
Shorebirds								
Marine mammals • Australian Snubfin Dolphin • Indo-Pacific Humpback Dolphin • Indo-Pacific Bottlenose Dolphin								
Turtles • Flatback • Olive Ridley								
Cultural heritage								
Recreational fishing, boating and tourism								

Priority protection area	No controls	Source control	Monitor and evaluate	Mechanical dispersion	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Shipwrecks							N/A	
Cape Hotham								
Shorebirds								
Marine mammals • Dugong • Australian Snubfin Dolphin • Indo-Pacific Humpback Dolphin • Indo-Pacific Bottlenose Dolphin								
Saltwater Crocodile								
Cultural heritage								
Joseph Bonaparte Gulf – East Coast								
Mangroves								
Wetlands of National Significance								
Birds • Migratory shorebirds • Seabirds								
Marine mammal • Dugong • Australian Snubfin Dolphin • Indo-Pacific Humpback Dolphin • Indo-Pacific Bottlenose Dolphin								
Saltwater Crocodile								

Priority protection area	No controls	Source control	Monitor and evaluate	Mechanical dispersion	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Turtles • Green • Olive Ridley • Flatback								
Tiwi Islands								
Mangroves								
Turtles • Flatback • Olive Ridley								
Saltwater Crocodile								
Marine Mammals • Australian Snubfin Dolphin • Spotted Dolphin • Orca • Spotted Bottlenose Dolphin • Australian Humpback Dolphin • Humpback Whale • Common Dolphin • Risso's Dolphin • Bottlenose Dolphin • Indian Ocean Bottlenose Dolphin • Blue Whale • Bryde's Whale • Dugong								

Priority protection area	No controls	Source control	Monitor and evaluate	Mechanical dispersion	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Birds • The Tiwi Islands support exceptionally high densities of the vulnerable Red Goshawk. They also support many migratory shorebirds including more than 1% of the world's Great Knots.								
Coral and other subsea benthic primary producers							N/A	
Socioeconomic • Tourism – charter boats, diving and snorkelling • Recreational fishing								
Cultural heritage								
Vernon Islands CR								
Mangroves								
Coral and other subsea benthic primary producers							N/A	
Saltwater Crocodile								
Shorebirds and seabirds (low abundance as island largely covered in mangroves)								

Priority protection area	No controls	Source control	Monitor and evaluate	Mechanical dispersion	Shoreline protection & deflection	Shoreline clean-up	OWR	OSM
Marine mammal • Dugong • Australian Snubfin Dolphin • Indo-Pacific Humpback Dolphin • Indo-Pacific Bottlenose Dolphin								
Cultural heritage								
Diving sites							N/A	

Key:	
	Beneficial impact
	Possible beneficial impact depending on the situation (e.g. timeframes and metocean conditions)
	Negative impact
N/A	Not applicable for the environmental value or not applicable for hydrocarbon type

6.8 Oil spill response ALARP assessment

For each response strategy included within this OPEP an environmental performance outcome has been determined and key control measures and performance standards have been identified such that the response can meet the required performance outcome. For each response strategy, an ALARP assessment has been conducted to demonstrate that the control measures mitigate the risk of an oil spill to ALARP.

Appendix B details the ALARP assessment framework and the results of the ALARP assessment conducted to inform the control measures and performance standards contained within this OPEP.

7. External notifications and reporting requirements

For oil spill incidents, the Emergency Commander / Vessel Master will notify the Perth-based IMT to delegate further notifications to relevant regulatory authorities and stakeholders, and to request further spill response assistance for Level 2/3 spills.

7.1 Regulatory and stakeholder notification and reporting

The Incident Commander delegates the regulatory reporting requirements. Typically, the delegated party is the Planning Section Chief.

Contact details for the regulatory agencies and stakeholders outlined in Table 7-1 are listed in the Incident Response Telephone Directory (SO-00-ZF-00025.020), which contains a more detailed list and contact details for incident response support. This directory is updated every 6 months; up-to-date revisions are available in the IMT room and online (SharePoint Procedures and Emergency Response pages).

Table 7-1 outlines the external reporting requirements specifically for oil spill incidents outlined in this OPEP in international, national, Territory and State jurisdictions (Note: Regulatory reporting may apply to smaller Level 1 spills that can be responded to using on-site resources as well as larger Level 2/3 spills). There are additional requirements for vessel masters to report oil spills from their vessels under relevant marine oil pollution legislation (e.g. MARPOL), including, where relevant, reporting oil spills to AMSA (RCC), the NT Government and WA DoT (MEER unit).

Table 7-1: Regulatory and stakeholder notification and reporting requirements (Commonwealth, state and international waters)

Regulator / stakeholder	Type of notification / timing	Legislation / guidance	Reporting requirements	Responsible person / group	Forms
NOPSEMA reporting requirements for Commonwealth water spills					
NOPSEMA (Incident Notification Office)	Verbal notification within 2 hours Written report as soon as practicable, but no later than 3 days	*Petroleum and Greenhouse Gas Storage Act 2006* Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations (2024)	A spill associated with the activity in Commonwealth waters that has the potential to cause moderate to significant environmental damage[1]	Notification by Planning Section Chief (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
National Offshore Petroleum Titles Administrator (NOPTA) (Titles Administrator)	Written report to NOPTA within 7 days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by Planning Section Chief (or delegate)	Provide same written report as provided to NOPSEMA
AMSA RCC[2]	Verbal notification within 2 hours of incident Written pollution report (POLREP) form, within 24 hours on request from AMSA	MARPOL 73/78	Santos to notify AMSA of any marine pollution incident[1]	Notification by Planning Section Chief (or delegate)	https://www.amsa.gov.au/forms/harmful-substances-report-polrep-oil
Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (Director of monitoring and audit section)	Email notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	If Matters of National Environmental Significance (MNES) are considered at risk from a spill or response strategy, or if there is death or injury to a protected species	Notification by Planning Section Chief (or delegate)	Not applicable
Parks Australia (24-hour Marine Compliance Duty Officer)	Verbal notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	An oil spill that occurs within a marine park or is likely to impact an AMP	Notification by Planning Section Chief (or delegate)	Not applicable, but this information should be provided: • Titleholder's details • Time and location of the incident (including name of marine park likely to be affected) • Proposed response arrangements as per the OPEP

Regulator / stakeholder	Type of notification / timing	Legislation / guidance	Reporting requirements	Responsible person / group	Forms
					• Confirmation of providing access to relevant monitoring and evaluation reports when available • Details of the relevant contact person in the IMT
Australian Fisheries Management Authority (AFMA)	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting marine oil pollution[1] Fisheries within the EMBA Consider a courtesy call if not in exposure zone	Notification by Planning Section Chief (or delegate)	Not applicable
If spill is heading towards NT waters					
NT Regional Harbourmaster	Verbal notification Follow up with POLREP as soon as practicable after verbal notification	NTOSCP As per Territory legislation (i.e. *Marine Pollution Act 1999*)	All actual or impending spills in Darwin Harbour waters, regardless of source or quantity	Notification by IMT Planning Section Chief (or delegate)	Email POLREPs to rhm@nt.gov.au (Regional Harbourmaster) Instructions for submitting POLREPs (including a POLREP Template – refer to Appendix C) are provided on the NT Government webpage: https://nt.gov.au/marine/marine-safety/report-marine-pollution
DEPWS (Pollution Response Hotline; Environmental Operations) Territory Emergency Controller (NT Police Commissioner or Delegate)	Verbal notification as soon as practicable Written report to be provided as soon as practicable after the incident, unless otherwise specified by the Minister	NTOSCP As per Territory legislation (i.e. *Marine Pollution Act 1999*)	All actual or impending spills in NT waters Notify if spill has the potential to impact wildlife in Territory waters (to activate the Oiled Wildlife Coordinator)	Notification by IMT Planning Section Chief (or delegate)	Email POLREPs to pollution@nt.gov.au (Environmental Operations) Instructions for submitting POLREPs (including a POLREP Template – refer to Appendix C) are provided on the NT Government web page : https://nt.gov.au/marine/marine-safety/report-marine-pollution https://ntepa.nt.gov.au/make-a-report

Regulator / stakeholder	Type of notification / timing	Legislation / guidance	Reporting requirements	Responsible person / group	Forms
NT Department of Primary Industry and Fisheries (DPIF)	Verbal notification, timing not specified	Not applicable	Fisheries within the EMBA Consider a courtesy call if not in exposure zone	Notification by Planning Section Chief (or delegate)	Not applicable
If spill is heading towards WA waters					
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) (Petroleum Environment Duty Officer)	Verbal phone call within 2 hours of incident being identified Follow up written notification within 3 days	Regulations 28, 29 and 30 of the Petroleum (Submerged Lands) (Environment) Regulations 2012 Guidance Note on Environmental Non-compliance and Incident Reporting (DEMIRS, 2022)	All actual or impending spills in State waters	Notification by Planning Section Chief (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Documents/Environment/ENV-PEB-189.docx
WA Department of Transport (WA DoT)[2] (MEER Duty Officer)	Verbal notification within 2 hours Follow up with POLREP (Appendix C) as soon as practicable after verbal notification If requested, submit Situation Report (SITREP) (Appendix D) within 24 hours of request	*Emergency Management Act 2005* SHP-MEE (WA DoT, 2024) Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (WA DoT, 2020)	Santos to notify of actual or impending Marine Pollution Incidents (MOP) that are in, or may impact, State waters Emergency Management Regulations 2006 define MOP as an actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment[1]	Notification by Planning Section Chief (or delegate) MEER Duty Officer contacted per Incident Telephone Directory	WA DoT POLREP (Appendix C): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf WA DoT SITREP (Appendix D): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
Department of Biodiversity Conservation and Attractions (DBCA) (State Duty Officer and Kimberley Regional Office)	Verbal notification as soon as reasonably practicable	WAOWRP	Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by Planning Section Chief (or delegate)	Not applicable
Department of Primary Industry and Regional Development (DPIRD) (Fisheries)	Verbal phone call notification within 24 hours of incident	As per consultation with DPIRD Fisheries	Reporting marine oil pollution[1] Notify if spill has the potential to impact or has impacted fisheries in State waters	Notification by Planning Section Chief (or delegate)	Not applicable

Regulator / stakeholder	Type of notification / timing	Legislation / guidance	Reporting requirements	Responsible person / group	Forms
Department of Water and Environmental Regulation (DWER)	Initial verbal or electronic notification of the discharge as soon as practicable Written notification of the incident to DWER's CEO, copied to the local DWER Industry Regulation Office, as soon as practicable	*Environmental Protection Act 1986* (Section 72) Environmental Protection (Unauthorised Discharge) Regulations 2004	Call DWER 24-hour Pollution Watch hotline Environmental Protection Act: Spill or discharge of hydrocarbons to the environment that has caused, or is likely to cause pollution, or material or serious environmental harm (Level 2/3 spills) Environmental Protection (Unauthorised Discharge) Regulations: Unauthorised discharge (where there is potential for significant impact or public interest) to environment of Schedule 1 material	Notification by Planning Section Chief (or delegate)	Reporting requirements: https://www.wa.gov.au/service/environment/pollutant-prevention/pollution-watch
If spill is heading towards international waters					
DFAT (24-hour consular emergency centre)	Verbal phone call notification within 8 hours, if the spill is likely to extend into international waters Follow up with email outlining details of incident	NP-GUI-007: National Plan coordination of international incidents: notification arrangements guidance (AMSA, 2017b)	Notify DFAT that a spill has occurred and is likely to extend into international waters Inform DFAT of the measures being undertaken to manage the spill NOPSEMA, DISR and DFAT will form an interagency panel—the Australian Government Control Crisis Centre	Notification by Planning Section Chief (or delegate)	Email details of incident to globalwatchoffice@dfat.gov.au
Autoridade Nacional do Petróleo (ANP) (Harbour Master of Dili Port, Deputy Harbour Master of Tibar Port, and ANP safety phone centre)	Verbal phone call notification within 8 hours if the spill is likely to extent into Timor-Leste waters Follow up with email outlining details of incident	As per consultation with ANP	Notify ANP of any oil spill that has entered or is likely to enter Timor-Leste waters. Notify the below: • Harbour Master of Dili Port • Deputy Harbour Master of Tibar Port	Notification by Planning Section Chief (or delegate)	Not applicable

Regulator / stakeholder	Type of notification / timing	Legislation / guidance	Reporting requirements	Responsible person / group	Forms
			• ANP safety phone centre		
Stakeholders (including Relevant Persons)					
Tiwi Resources (Ranger Coordinator), Tiwi Land Council and the delegated Clan Trustees	Verbal phone call notification within 8 hours of incident being identified Follow up with email outlining details of incident	Not applicable	All spills heading towards the Tiwi Islands	Notification by Planning Section Chief (or delegate)	Not applicable
First Nation Consultative Committees (as agreed through the post acceptance consultation implementation process)	Verbal phone call notification within 8 hours of incident being identified Follow up with email outlining details of incident	Not applicable	All spills heading towards relevant parties' interests	Notification by Planning Section Chief (or delegate)	Not applicable
Other First Nation groups (as agreed through the post acceptance consultation implementation process and through the Northern Land Council)	Verbal phone call notification within 8 hours of incident being identified Follow up with email outlining details of incident	Not applicable	All spills heading towards relevant parties' interests	Notification by Planning Section Chief (or delegate)	Not applicable
Western Australian Fishing Industry Council (WAFIC) and WA commercial fisheries	Phone call within 24 hours of incident being identified with potential impact to the WA commercial fisheries. Follow up with email where available.	As per consultation with WAFIC	Should impact be expected to WA commercial fisheries	Notification by Planning Section Chief (or delegate)	Santos' list of WA commercial fisheries for this activity

1: For clarity and consistency across Santos regulatory reporting requirements, Santos will meet the requirement of reporting a marine oil pollution incident by reporting oil spills assessed to have an environmental consequence of moderate or higher, in accordance with Santos' environmental impact and risk assessment process outlined in Section 5 of the EP.

2: Only Santos reporting requirements are listed. For oil spills from vessels, vessel masters also have obligations to report spills from their vessels to AMSA RCC; in NT waters the NT Pollution Response Hotline and the DEPWS; and, in State waters, WA DoT MEER.

7.2 Activation of external oil spill response organisations and support agencies

Table 7-2 outlines notifications that should be made to supporting agencies to assist with spill response activities outlined in this plan. This list contains key OSROs that have pre-established roles in assisting Santos in an oil spill response. It is not an exhaustive list of all providers that Santos may use for assisting with an oil spill response.

Table 7-2: List of spill response support notifications

Organisation	Indicative timeframe	Type of communication	Resources available	Activation instructions	Santos person responsible for activating
AMOSC Duty Officer	As soon as possible but within 2 hours of incident being identified	Verbal Service Contract	Santos is a Participating Member of AMOSC and can call upon AMOSC personnel and equipment (including oiled wildlife). Under the AMOSPlan, Santos can also call upon mutual aid from other trained industry company personnel and response equipment AMOSC's stockpiles of equipment include dispersant, containment, recovery, shoreline clean-up, oiled wildlife and communications equipment. Equipment is located in Geelong (Victoria), Fremantle, Exmouth and Broome (all in WA)	**Step 1.** Obtain approval from Incident Commander to mobilise AMOSC. **Step 2.** Notify AMOSC that a spill has occurred. Put on standby as required – activate if spill response escalates to mobilise spill response resources consistent with the AMOSPlan. **Step 3.** Email confirmation and a phone call to AMOSC will be required for mobilising response personnel and equipment. Only a Santos call-out authority (registered with AMOSC) can activate AMOSC—they will be required to supply their credentials to AMOSC. A signed service contract note must also be completed by the Santos call-out authority and returned to AMOSC before mobilisation.	Planning Section Chief (or delegate) will notify AMOSC (upon approval from Incident Commander)
Aviation service provider	Within 2 hours of incident being identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place	Phone call	Logistics Section Chief (or delegate)
Duty Officers/ Incident Commanders (Woodside, Chevron, Jadestone)	Within 2 hours of incident being identified	Verbal	Mutual aid resources (through AMOSC mutual aid arrangement)	Phone call	Incident Commander (or delegate)
Toll – freight & logistics	Within 2 hours of incident being identified	Verbal	Assistance with mobilising equipment and loading vessels	Phone call	Logistics Section Chief (or delegate)
Waste service provider/s	As required for offshore and shoreline clean-up activities	Verbal	Santos has contract arrangements in place with waste service providers to take overall responsibility to transport and dispose of waste material generated through clean-up activities	Phone call to the primary contact person. in the event the primary contact person is not available, the secondary contact person will be contacted.	Logistics Section Chief (or delegate)
OSM services provider	OSM Plan initiation criteria are met (Tables 9-1 and 9-2 of the Joint Industry OSM Framework [APPEA, 2021])	Verbal and written	Santos is a member of OSRL's OSM Services Supplementary Agreement, providing access to personnel and equipment for OSM	**Refer to Northern Australia OSM-BIP (7715-650-ERP-0003) for full activation instructions** **Step 1.** Obtain approval from Incident Commander to activate OSM services provider.	Environment Unit Leader (or delegate)

Organisation	Indicative timeframe	Type of communication	Resources available	Activation instructions	Santos person responsible for activating
				Step 2. Verbally notify OSM services provider followed by submitting the Call-off Order Form. **Step 3**. OSM services provider commences activation process.	
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When OMP: Hydrocarbon Properties and Weathering Behaviour at Sea is activated (Section 18)	Verbal	Oil analysis including gas chromatography/mass spectrometry fingerprinting	Phone call	Planning Section Chief (or delegate)
OSRL, OSRL Duty Manager	Within 2 hours of incident being identified	Verbal OSRL Mobilisation Authorisation Form	Santos has an SLA with OSRL, which includes providing support functions, equipment and personnel to meet a wide range of scenarios At a minimum, OSRL will provide technical support to the IMT and place resources on standby Further details available on the OSRL webpage	**Step 1**. Contact OSRL duty manager in Singapore and request assistance from OSRL. **Step 2**. Send notification to OSRL as soon as possible after verbal notification. **Step 3**. Upon completing the OSRL incident notification form, OSRL will plan and place resources on standby. **Step 4**. Mobilisation of personnel (beyond 5 technical advisors x 5 days) and equipment requires signed mobilisation form by designated call-out authorities.	Designated call-out authorities (including Incident Commanders)
TRG	As soon as possible but within 2 hours of incident being identified	Verbal and written	Santos has arrangements with TRG for providing trained field response personnel	Contact TRG duty officer	Designated call-out authorities (including Incident Commanders)
RPS Group	As soon as possible but within 2 hours of incident being identified	Verbal and written	Santos has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, which will be undertaken for any spill greater than Level 1. AMOSC can also run modelling on behalf of Santos, if required, as part of contracting arrangements with RPS Group	Contact RPS Group duty officer	Environment Unit Leader (or delegate)
Wild Well Control Inc. (WWCI)	Within 4 hours of a loss of well control incident being identified	Loss of well control only Verbal	Well intervention services. Under contract	**As per Source Control Planning and Response Guideline (DR-00-OZ-20001):**	Drilling Representative

Organisation	Indicative timeframe	Type of communication	Resources available	Activation instructions	Santos person responsible for activating
				Step 1. Following Santos management confirmation of a subsea loss of containment, the Santos Incident Command Team (IMT) Drilling Representative calls the WWCI 24-hour emergency hotline number to notify them of the incident. **Step 2.** As soon as practical after initial notification and once the scale of the subsea loss of containment is confirmed, an emergency mobilisation authorisation form must be filled out, signed off by the authorised Santos Manager and sent through to WWCI. Obtain the most current emergency mobilisation form from the WWCI emergency hotline attendant. The form shall be submitted as directed by WWCI, as advised by the emergency hotline attendant.	

7.3 Environmental performance

Table 7-3 lists the environmental performance outcome, control measures, performance standards and measurement criteria for external notifications and reporting.

Table 7-3: Environmental performance – external notification and reporting

Environmental performance outcome	Make notifications and reports within regulatory and defined timeframes.		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
External notifications and reporting plan	**Response preparedness**		
	Santos Incident Response Telephone Directory (SO-00-ZF-00025.020)	[EPS-RP-001] Incident Response Telephone Directory is revised every 6 months	Incident Response Telephone Directory Document revision history
	OPEP communications test	[EPS-RP-002] OPEP contact details for regulatory and service provider notifications are checked annually	OPEP communications test records
	Response implementation		
	External notifications and reporting tables	[EPS-RP-003] External notification and reporting undertaken as per Table 7-1 and Table 7-2	Incident log

8. Incident action planning

The incident action planning process comprises these phases:

1. Understand the situation.
2. Establish incident priorities, objectives and tasks.
3. Develop a plan (IAP).
4. Prepare and disseminate the plan.
5. Implement, evaluate and revise the plan for the next operational period.

The Santos IMT will use the incident action planning process to determine and document the appropriate response priorities, objectives, strategies and tasks to guide the incident response; these are reviewed and updated as more information becomes available. The IMT will use an IAP for each operational period following the initial first-strike assessments, notifications, and activations.

When acting as the support agency, Santos may be requested by the Control Agency to develop or support the development of an IAP to help guide the incident response.

The Santos incident action planning process is built on the phases described in Figure 8-1.

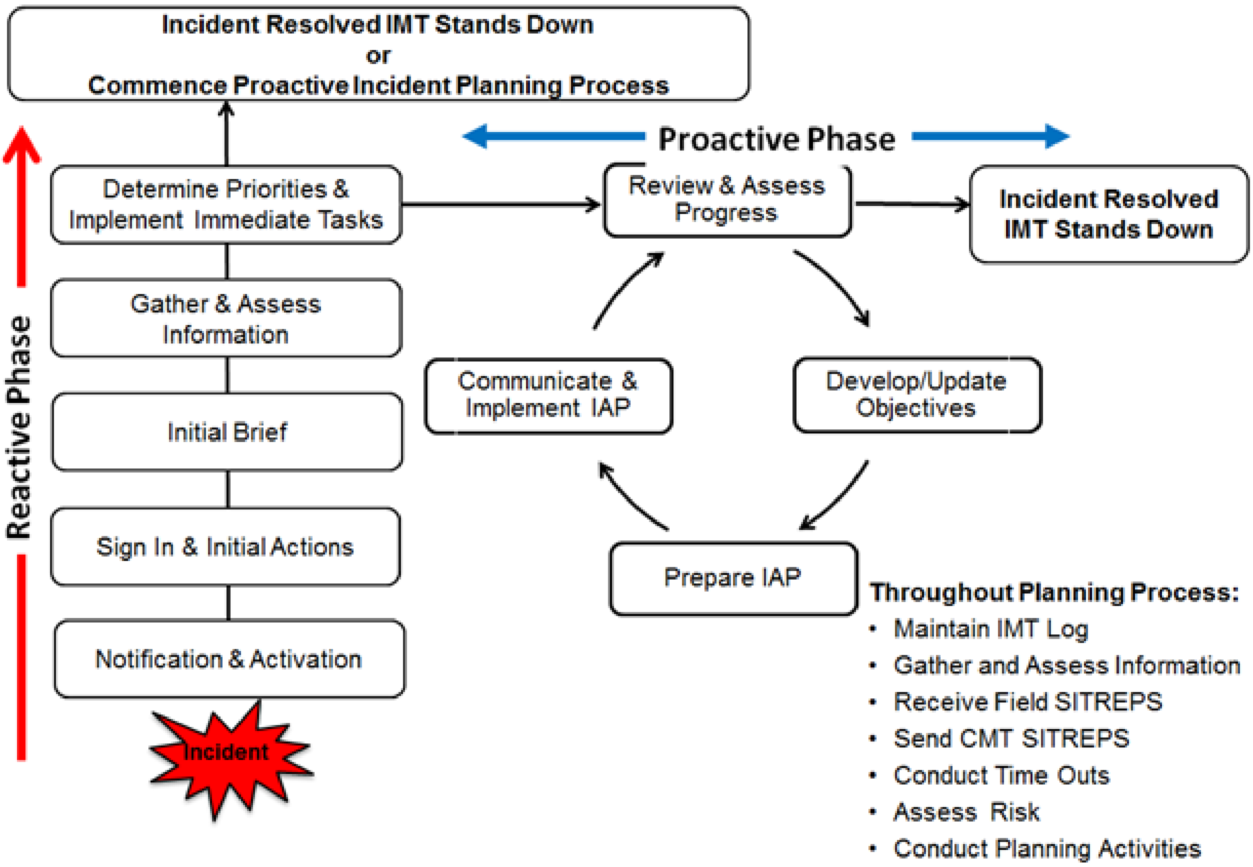

Figure 8-1: Incident action planning process

8.1 Reactive phase planning

The initial phase of the incident action planning process can be considered a reactive phase (indicatively lasting up to 48 hours) where information on the incident is progressively established from reports coming in from the field. During this phase there is no formal IAP to follow (the incident has just begun and details are still being established); however, the OPEP (this document) has been prepared to contain all first-strike oil spill response actions required to be followed during this phase in lieu of a formal IAP.

First-strike response actions are summarised in Section 2, which also provides links to relevant oil spill strategy sections in the OPEP that contain a more detailed list of implementation actions and considerations as well as statements of performance (performance standards) that must be followed to ensure the initial response meets regulatory requirements and environmental performance outcomes.

For each credible oil spill scenario covered by this OPEP, the first-strike response actions have been informed by a pre-assessment of applicable oil spill response strategies, priority response locations and a strategic NEBA (also referred to as a SIMA). This planning is included in Section 6. During the reactive phase, the strategic NEBA is reviewed and, using the specific information gathered from the spill, becomes an operational NEBA. This assessment helps verify that the response strategies pre-selected for each spill scenario are providing the best environmental outcome for the incident response.

8.2 Developing an incident action plan

At the end of the reactive phase and once the incident specifics have been determined, a more formal phase of spill response is entered, whereby a documented IAP is developed to guide the incident response activities for the next operational period. An operational period is defined as the period scheduled for carrying out the actions specified in the IAP. The next operational period is nominally a daily period but for long-running incidents it may be extended further once the pace of the incident response has settled, and the level of new information has decreased.

As IAPs and response strategies are implemented, their performance is monitored. The performance measurement results are fed back into the IMT to provide the IMT with greater situational awareness to enable the effective formulation of the next IAPs. Response strategies that are effective are continued or increased, and ineffective strategies are scaled back or stopped.

The performance against the objectives of the IAP must be documented in the Incident Log by the IMT. This provides the IMT with information required to help formulate the next IAP and provides evidence of Santos' response to the incident for regulatory and legal investigations that will follow the termination of the incident.

IAP performance is monitored through IMT communication with in-field response personnel, both verbally and through logs/reports/photos sent throughout the response by those (e.g. surveillance personnel, team leaders, laboratory chemists) who report on the effectiveness of the response strategies.

IAP forms and processes are documented in the Santos SharePoint Oil Spill Response Tile and in the Santos Offshore ER Documentation SharePoint site. Subfolders list all forms required to conduct incident action planning. Each functional position within the IMT has subfolders that contain forms and processes unique to the functional position on the Oil Spill Tile.

8.3 Environmental performance

Table 8-1 lists the environmental performance outcome, control measures, performance standards and measurement criteria for incident action planning.

Table 8-1: Environmental performance – incident action planning

Environmental performance outcome	Manage incident via a systematic planning process		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
Incident action planning	**Response preparedness**		
	IMT Exercise and Training Plan	[EPS-RP-005] Incident action planning and NEBA is practiced by the IMT during exercises	Exercise records
	TRPs	[EPS-RP-012] A TRP will be written for Tiwi Islands prior to activity commencement	TRP
	Response implementation		
	IAP	[EPS-RP-006] IAP is completed for each operational period and approved by the Incident Commander	Incident log IAP(s)
		[EPS-RP-007] Monitor effectiveness of response strategies being implemented and use information in the development of IAPs	Incident log IAP(s)
	NEBA	[EPS-RP-008] An operational NEBA will be undertaken for each operational period of the incident	NEBA IAP

Environmental performance outcome	Manage incident via a systematic planning process		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
	IMT activation and de-escalation	[EPS-RP-009] IMT will be activated immediately once notified of a Level 2/3 spill (to Incident Commander)	IAP
		[EPS-RP-010] The decision to de-escalate the IMT will be made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other statutory authorities that play an advisory role	NEBA IAP
	TRPs	[EPS-RP-011] If operational monitoring shows that shoreline contact of Protection Priority Areas is likely, TRPs will be developed or sought from other titleholders/ regional industries prior to shoreline contact	TRP

9. Source control

The initial and highest priority response to an oil spill incident is the health and safety of on-site personnel, followed by preventing or limiting further loss of hydrocarbons to the environment.

For major hydrocarbon release incidents at Barossa facilities, the BW Opal Emergency Response Plan (BAF-213 6896) outlines the initial actions to be taken by on-site personnel to control the source of a hydrocarbon spill and limit the volume released to the environment.

For vessels with a SOPEP, the SOPEP will provide the relevant initial actions to control the source of the spill.

For the ongoing response to a well-leak incident, the Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) is the overarching source of information for implementing a relief well response.

The sections below outline the source control activities—the BW Opal Emergency Response Plan (BAF-213 6896), Vessel SOPEP and Source Control Planning and Response Guideline (DR-00-OZ-20001), where applicable, will provide a higher level of detail for specific incidents.

9.1 Spills from refuelling, cargo loading or FPSO topside equipment failure

Table 9-1 lists the environmental performance outcome and initiation and termination criteria for source control of spills from refuelling, cargo loading or FPSO topside equipment failure. The Emergency Commander and/or Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 9-1: Spills from refuelling, cargo loading or FPSO topside equipment failure – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment		
Initiation criteria	Notification of a spill		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓	✗	✓
Termination criteria	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbons		

9.1.1 Implementation guidance

Implementation guidance is summarised in Table 9-2. All refuelling operations will comply with the Barossa Bunkering Operation Procedure (BAF-213 5927). For Barossa Condensate export (from FPSO to tanker), offtake activities will take place in line with the Barossa Terminal Handbook (BAF-206 4299).

During bunkering and cargo loading activities, pipe/hose rupture, coupling failure, or tank overfilling can cause an unplanned hydrocarbon release. Once the leak is detected, pumps will be turned off and bunkering/ cargo loading will cease as per the BW Opal Emergency Response Plan (BAF-213 6896). The hydrocarbon remaining in the transfer line may escape to the environment as well as any hydrocarbon released before the transfer operation is stopped.

If a rupture or leak occurs in the topside processing equipment, subsea and topside valves will be shut off and production will cease in accordance with the BW Opal Emergency Response Plan (BAF-213 6896). Shut-off valves are regularly serviced and tested to ensure they will function properly if required. Released oil will be captured in the FPSO's bunding system, which has closed drainage systems that can deliver drainage water (which may contain hydrocarbon contamination) to a designated storage tank. The FPSO also has a closed drainage system for capturing leaks on the vessel. The mitigation measures to be followed include:

- immediately cease pumping/processing operations following a spill
- immediately shut down the system receiving the product following a spill
- close the drainage network as soon as practicable following the spill to prevent discharge to the ocean
- recover hose and identify leak
- make necessary repairs

- use spill kit to clean-up spills on the vessel
- store any clean-up waste in bunded area for onshore disposal.

Sorbent materials will be used from spill kits on the vessel to mop up hydrocarbon spills on deck. Soiled sorbent materials will be bagged and disposed to shore as a controlled waste.

Areas used to permanently or temporarily store bulk fuels and/or chemicals are fully bunded with deck drainage sealed (secondary containment) to prevent accidental discharges to the ocean. Bunding located beneath the refuelling hose connections, operational equipment, fuel tanks on the supply vessel and closed drains on the FPSO will isolate a potential spill that falls in these areas, and prevent it from reaching the marine environment.

Table 9-2: Implementation guidance – refuelling, cargo loading or FPSO topside release

Action		Consideration	Responsibility	Complete
Initial actions	In the event of a loss of production hydrocarbons from FPSO topsides production equipment, consult the BW Opal Emergency Response Plan (BAF-213 6896)	-	Emergency Commander	☐
	For refuelling and chemical transfers between support vessels and between support vessels and offshore platforms, consult the Refuelling and Chemical Management Standard (SO-91-IQ-00098)	• For spills during pumping operations, cease pumping activity immediately • Isolate damaged, leaking equipment • If drainage is open to the marine environment, isolate drainage as soon as practicable following the spill to prevent discharge to the ocean (the Vessel Master or Emergency Commander will confirm that the drainage network is closed on the vessel before washing down the deck after excess oil has been cleaned up) • Use on-site spill kit resources (i.e. sorbent material) to clean-up spills • Recover dropped containers where practicable, where containers of hydrocarbons are dropped during vessel to platform transfers • Dispose of contaminated waste to licenced waste contractor • Isolate and repair damaged, leaking equipment.	Vessel Master/ Emergency Commander	☐

9.2 Subsea flowline rupture

Table 9-3 lists the environmental performance outcome and initiation and termination criteria for source control response to a subsea flowline rupture. The On-scene Commander (OSC) and/or Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 9-3: Subsea flowline rupture –environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement source control methods to stop the release of hydrocarbons into the marine environment		
Initiation criteria	Subsea flowline rupture or leak		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✗	✗	✓
Termination criteria	The hydrocarbon inventory in the ruptured subsea flowline has been isolated and the release to the marine environment has been stopped		

9.2.1 Emergency shutdown

The primary response on detecting a leak in the subsea production system is to isolate the affected wells or drill centre to prevent further inflow of production fluids to the leak site; this is typically done via a controlled shutdown. The applicable flowline could be de-pressured via topsides to reduce the leak rate.

The BW Opal Emergency Response Plan (BAF-213 6896) outlines first-strike actions, including emergency shutdowns, for subsea oil spill incidents.

9.2.2 Implementation guidance

The implementation guidance is summarised in Table 9-4.

Equipment

If safe to do so, an inspection class ROV will be mobilised to visually identify any subsea incident. Inspection class ROVs are readily available in WA, although the suitability of any particular ROV will depend on conditions at the incident site (e.g. water depth, metocean conditions, prevailing weather).

Typically, an ROV could be available for deployment from a WA port within 2–14 days.

An alternative third-party vessel could be available within 3–21 days depending on the specification required to work at the location.

Personnel

Supervisory personnel required for any vessel deployment are to be sourced from Santos's Perth or Barossa Production Operations team and local contract personnel. A minimum level of competency and experience, appropriate to the task, will be assessed by the IMT before undertaking the task.

Table 9-10 lists the environmental performance standards and measurement criteria for this strategy.

Table 9-4: Implementation guidance – subsea flowline rupture

Action		Consideration	Responsibility	Complete
Initial actions	In the event of a subsea flowline rupture or leak, consult the BW Opal Emergency Response Plan (BAF-213 6896).	-	Emergency Commander	☐
	The IMT will initiate a site survey within 24 hours of the incident being detected that will collect relevant site-specific information. Reasoned responses will be initiated when the assessment is complete.	Variables to be considered in the assessment include: • flowline construction, including presence of mechanical fittings, inline valves/manifolds • flowline contents composition • flowline inventory volume • flowline operational history • pressure and temperature • location of leak, proximity to topside structures, other subsea assets • opportunities to visually identify leak site • topography • inventory displacement by with treated seawater or nitrogen.	Incident Commander	☐
Ongoing actions	The IMT will collate, assess and handover above information to Facilities Engineering Manager. Santos Engineers will devise a solution and a project team will be assigned to implement the recovery and repair phase(s) using the engineering solution.	-	Incident Commander	☐

9.3 Vessel collision – fuel tank rupture

Table 9-5 lists the environmental performance outcome and initiation and termination criteria for source control response to a fuel tank rupture from vessel collision. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 9-5: Vessel collision – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement source control methods to stop the release of hydrocarbons into the marine environment		
Initiation criteria	Notification of a spill		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓	✓	✓
Termination criteria	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbons		

9.3.1 Implementation guidance

Implementation guidance is summarised in Table 9-6. If hydrocarbons (i.e. MDO, Barossa Condensate or HFO) are released from a vessel (including the FPSO or offtake tanker) due to a ruptured fuel tank, the relevant vessel-specific procedures will be applied. For offtake tankers and support vessel collisions, the vessel's SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident.

For vessel collision involving the Barossa FPSO (*BW Opal*), the *BW Opal Shipboard Marine Pollution Emergency Plan (SMPEP)* (BAF-213 5230) and BW Opal Emergency Response Plan (BAF-213 6896) will be followed.

Table 9-10 lists the environmental performance standards and measurement criteria for this strategy.

Table 9-6: Implementation guidance – fuel tank rupture

Action		Consideration	Responsibility	Complete
Initial actions	The vessel's SOPEP, as applicable under MARPOL, or procedure for responding to a ruptured tank will be followed, as applicable.	Notwithstanding vessel-specific procedures for source control, these activities would be evaluated immediately for implementation, providing it is safe to do so: • Reduce the head of fuel by dropping or pumping the tank contents into an empty or slack tank. • Consider pumping water into the leaking tank to create a water cushion to prevent further fuel inventory loss. • If the affected tank is not easily identified, reduce the fuel level in the tanks in the vicinity of the suspected area if vessel stability will not be compromised. • Evaluate the transfer of fuel to other vessels. • Trim or lighten the vessel to avoid further damage to intact tanks. • Attempt repair and plugging of hole or rupture.	Vessel Master	☐

9.4 Production well leak

Table 9-7 lists the environmental performance outcome and initiation and termination criteria for controlling the source of a production well leak.

Table 9-7: Production well leak –environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement source control methods to stop the release of hydrocarbons into the marine environment		
Initiation criteria	Well leak		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	×	×	✓
Termination criteria	The well leak is stopped to prevent any further release of hydrocarbon to the environment		

9.4.1 Emergency shutdown

The primary response on detecting a leak in the subsea production system would be to isolate the affected wells or drill centre to prevent further inflow of production fluids to the leak site; this is typically done via a controlled shutdown. The applicable flowline could be de-pressured via topsides to reduce the leak rate.

In addition, the FPSO's ESD System is in place to isolate and limit the loss of hydrocarbons from a subsea well control incident. The BW Opal Emergency Response Plan (BAF-213 6896) outlines first-strike actions, including emergency shutdowns, for subsea oil spill incidents.

9.4.2 Relief well drilling

Relief well drilling is the primary strategy to control a well leak that cannot be controlled via a controlled shutdown and/or on-site systems.

The Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for drilling a relief well.

9.4.2.1 Relief well planning

Relief well planning is embedded into the Santos Drilling & Completions Management Process (DCMP). These industry-accepted guidelines have been adopted to assist relief well planning requirements:

- Society of Petroleum Engineers (SPE) Calculation of Worst Case Discharge Rev 1, 2016 (SPE, 2016): This is used as part of the prospect screening review to generate a credible rate for oil spill modelling.
- Offshore Energies UK (OEUK) Relief Well Planning for Offshore Wells Guideline, Issue 3, 2024 (OEUK, 2024): This methodology is used to confirm a well complexity analysis.

The following campaign / well-specific source control plans have been developed for the Barossa wells and contain relevant information that applies for relief well planning for a leak from any Barossa production well:

- Barossa Development Wells Source Control Plan (7720-390-ERP1-0001)

This plan contains relief well planning information, specifically:

- MODU positioning assessment for relief well drilling locations
- relief well tangible equipment requirements and availability
- relief well trajectory analysis and casing design
- dynamic well-kill hydraulic simulation results.

These are static reports developed prior to higher-risk campaign-specific activities. Although they contain planning that would be relevant to drilling a relief well for any well release (e.g. MODU positioning locations), time-variable information, such as MODU availability, is only assessed for the duration of the campaign.

To ensure Santos has current MODU availability, Santos maintains a register of MODU activity within the region and updates this monthly. The MODU capability register includes information about:

- MODU name
- MODU contract status (operator and contract duration)
- current location

- maximum water depth capability
- MODU type (floating vs jack-up; mooring type; MODU design/class)
- available drilling envelope
- blowout preventer (BOP) specifications
- BOP /lower marine riser package (LMRP) connector specifications
- mud pump specifications/capability
- choke and kill line internal diameters
- storage capability (i.e. MDO, base-oil, brine, drill-water, potable water, bulks)
- NOPSEMA safety case (yes/no).

To facilitate and expedite the use of regional MODU for relief well drilling, an AEP MoU: Mutual Assistance is in place. This agreement provides the mechanism to transfer drilling units and well-site services between operators in Australian and Timor-Leste administered waters in order to respond urgently to emergency source control events.

A Safety Case revision will be required for the relief well MODU to undertake the activity; this cannot be submitted before the event. The Safety Case revision will be based on existing documents, including the in-force Safety Case for the relief well MODU, if one is available. A Safety Case revision would be submitted within 14 days from the well incident; however, the critical path time allowed for writing of the document is 3 days. The remaining estimated time would be used for gathering post-event data, mobilising the workforce and conducting a hazard identification. It is not practicable to reduce the critical path days with additional pre-planning as document revision, final review and approval will still be required after completing the hazard identification.

9.4.2.2 Relief well schedule

An indicative relief well drilling schedule is provided in Table 9-8. This is based on controlling the well within 13 weeks (90 days). This period is based on indicative mobilisation durations, relief well planning and operations. Timelines for the relief well rig being made available at the Barossa location have been estimated in line with Section 13.9 in the Australian Offshore Titleholders Source Control Guideline Rev 0 (APPEA, 2021). It could take up to 36 days to have a relief well MODU on site ready to spud.

This timeline has been assessed as ALARP based on the current controls/measures in place; however, Santos is actively working with industry to evaluate measures to improve on the ALARP response-time model through the AEP Drilling Industry Steering Committee Source Control Response Industry (SCRI) Working Group. This working group was established to drive collaboration and continuous improvement in source control emergency response planning. The working group will explore and act on opportunities to align and strengthen the Titleholders' source control emergency response capability through mutual aid initiatives and drive continuous improvement by implementing fit-for-purpose and effective source control emergency response strategies.

Table 9-8: Schedule for MODU arriving on site and drilling the relief well

Production well-leak relief well schedule		
Task	**Duration (days)**	**Controls**
Event reported – begin mobilising MODU for relief well drilling	2	• On-site communications • Active IMT on call including Operations/Drilling Team Lead
• Relief well MODU confirmed • Relief well MODU suspends operations and mobilises to relief well location • Concurrently, prepare relief well design and dynamic kill plan	7	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Barossa Development Wells Source Control Plan (7720-390-ERP1-0001) • Regional MODU tracking • AEP MoU: Mutual Assistance
• Transit to site (estimated distance of 1,130 nm at ~2.5 knots tow speed, using North West Shelf [NWS] for planning purposes) • Concurrently, prepare relief well MODU Safety Case Revision and submit to NOPSEMA	19	• Stood-up Relief Well Team (as per Santos Offshore Source Control Planning and Response Guideline [DR-00-OZ-20001]) • Barossa Development Wells Source Control Plan (7720-390-ERP1-0001) • Relief well drilling specialists services contract (WWCI) • Drilling services contracted

Production well-leak relief well schedule		
Task	**Duration (days)**	**Controls**
• Prepare relief well WOMP and submit to NOPSEMA		• Pre-verified access to relief well equipment (e.g. casing, wellhead) • AEP MoU: Mutual Assistance
Mobilise MODU to well offset location (depends on current and prevailing weather)	8	• Vessel and rig move services contracted
Total days before arrival, ready to spud/commence relief well operations	**36**	-
Drill and construct relief well and carry out dynamic well-kill operations	54	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Relief Well Drilling specialist services contract (WWCI)
Total days from notification of well leak to well kill	**90**	-

9.4.3 Source control implementation guidance

The Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for implementing source control methods.

A high-level summary of source control implementation actions is provided in Table 9-9.

Table 9-9: Implementation guidance – well leak

	Action	Responsibility	Complete
Initial actions	**Relief well**		
	Implement the Source Control Planning and Response Guideline (DR-00-OZ-20001).	Relief Well Team Leader	☐
	Notify Santos Drilling and Completions Team to assemble a Source Control Team and immediately begin preparations.	Relief Well Team Leader	☐
	Notify well control service provider personnel for mobilisation.	Relief Well Team Leader and Source Control Branch Director	☐
	Source MODU through nearby drilling operations if available or procure from nearest operator through mutual aid agreement MoU.	Source Control Branch Director	☐
	Refine, as necessary, the relief well planning work described in Section 9.4.2.1, and have prepared in time to procure equipment and personnel before MODU arrives on location.	Source Control Branch Director	☐
	Assess relief well equipment and personnel requirements. Procure and make ready.	Logistics Section Chief	☐
	Deploy equipment and personnel to site to begin spud and drill.	Relief Well Team Leader	☐
Ongoing actions	**Relief well**		
	Design relief well, using relief well planning work, as applicable, and have prepared in time to procure equipment and personnel before MODU arrives on location.	Source Control Branch Director	☐
	Assess relief well equipment and personnel requirements. Procure and make ready.	Logistics Section Chief	☐
	Deploy equipment and personnel to site to begin spud and drill.	Relief Well Team Leader	☐
	Monitor progress of relief well drilling and communicate to IMT.	Relief Well Team Leader	☐

9.5 Environmental performance

Table 9-10 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 9-10: Environmental performance – source control

Environmental performance outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
Response preparedness			
Source control – relief well drilling	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) provides guidance for well-specific source control planning and response, and includes the Santos Source Control Emergency Response Plan in Section 7	[EPS-SC-022] The Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) is in place and up-to-date during the activity	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001)
	Relief Well Rig Capability Register is maintained during the activity to monitor MODUs potentially available for relief well drilling	[EPS-SC-026] Relief Well Rig Capability Register, to monitor rigs currently present in Australasia and record relevant details including rig specifications, contract status and safety case approvals, is maintained during the activity through monthly monitoring	Relief Well Rig Availability Register
	Contract and Equipment Access Agreement with WWCI	[EPS-SC-024] Contract and Equipment Access Agreement with WWCI are maintained providing technical support and equipment	Contract with WWCI
	Arrangements for source control emergency response personnel	[EPS-SC-025] Arrangements for access to source control personnel are maintained during the activity	Contracts/MoUs for source control personnel
	Relief well drilling supplies readily available in WA	[EPS-SC-035] Long-lead equipment for relief well drilling will be readily available to Santos	Relief well equipment contract(s)/ invoice(s) Relief well equipment inventory report(s) Well-specific source control plan[28]
Source control – vessel collision spill control	Vessel Spill Response Plan (SOPEP/ shipboard marine pollution emergency plan [SMPEP])	[EPS-SC-001] Activity/support vessels have a SOPEP or SMPEP that outlines procedures to combat spills	Audit records Inspection records
		[EPS-SC-002] Spill exercises on activity/support vessels are conducted as per the vessels' SOPEP or SMPEP	Spill exercise close-out reports
Source control – refuelling / cargo loading / FPSO topside equipment failure / subsea flowline rupture spill control	Facility Emergency Response Plan	[EPS-SC-047] The Emergency Response Plan is in place and up-to-date during the activity	BW Opal Emergency Response Plan (BAF-213 6896)

[28] *All Barossa development wells are covered in the Barossa Development Wells Source Control Plan (7720-390-ERP1-0001).*

Environmental performance outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
Response implementation			
Source control – relief well drilling	Santos Source Control Branch	[EPS-SC-029] Source Control Branch mobilised within 24 hours of being notified of the well release	Incident log
	Well control specialists	[EPS-SC-031] Well control specialists mobilised within 72 hours of being notified of the well release	Incident log
	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) provides guidance for well-specific source control planning and response, and includes the Santos Source Control Emergency Response Plan in Section 7	[EPS-SC-028] Relief well drilling implemented in accordance with the Source Control Planning and Response Guideline (DR-00-OZ-20001) during a well release	Incident log
Source control – vessel collision spill control	Vessel Spill Response Plan (SOPEP/SMPEP) implemented	[EPS-SC-003] Actions to control spill associated with a vessel incident followed in accordance with SOPEP or SMPEP	Vessel logs
Source control – refuelling / cargo loading / FPSO topside equipment failure / subsea flowline rupture spill control	Facility Emergency Response Plan	[EPS-SC-049] Actions to control loss of containment from production well/ flowline release are in accordance with the relevant facility Emergency Response Plan	Incident log BW Opal Emergency Response Plan (BAF-213 6896)

10. Monitor and evaluate

Understanding the behaviour and likely trajectory of an oil spill is critical for evaluating the appropriate response strategy. Several methods can be used to monitor and evaluate, including:

- vessel surveillance
- aerial surveillance
- tracking buoys
- oil spill trajectory modelling
- satellite imagery.

10.1 Vessel surveillance

Table 10-1 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 10-1: Vessel surveillance – environmental performance outcome, initiation and termination criteria

<table>
<tr><td>Environmental performance outcome</td><td colspan="3">Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making</td></tr>
<tr><td>Initiation criteria</td><td colspan="3">Notification of a Level 2/3 spill – may be deployed in a Level 1 incident (to be determined by OSC)</td></tr>
<tr><td rowspan="2">Applicable hydrocarbons</td><td>MDO</td><td>HFO</td><td>Barossa Condensate</td></tr>
<tr><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Termination criteria</td><td colspan="3">• Vessel-based surveillance is undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable, OR
• NEBA is no longer being achieved, OR
• Agreement is reached with Jurisdictional Authorities to terminate the response</td></tr>
</table>

Direct observations from field support or other vessels can be used to assess the location and visible extent of the hydrocarbon incidents, and to verify modelling predictions and trajectories. Due to the proximity of observers to the water's surface, vessel surveillance is limited in its coverage compared to aerial surveillance and may also be compromised in rough sea state conditions or where fresh hydrocarbons at the surface pose safety risks.

10.1.1 Implementation guidance

Table 10-2 provides guidance to the IMT on the actions and responsibilities to be considered when selecting this strategy. Table 10-3 lists resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to start initial vessel surveillance operations are listed in

Table 10-4. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 10-21 lists the environmental performance standards and measurement criteria for this strategy.

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Table 10-2: Implementation guidance – vessel surveillance

Action		Consideration	Responsibility	Complete
Initial actions	Notify nearest available support vessel to commence surveillance.	Current Santos on-hire vessels or vessels of opportunity (VOO) can be used. Automatic Identification System (AIS) vessel tracking is available through Santos' ER SharePoint page.	On-Scene Commander Operations Section Chief	☐
	Source additional contracted vessels for assistance, if required.	Refer to Santos Vessels for Oil Spill Response (7110-650-ERP-0001) for the vessel monitoring process and guidance on vessel types.	Logistics Section Chief	☐
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms (Appendix E) and provide to OSC (Level 1 spills) or IMT (Level 2/3 spills).	Photos are to be taken where possible and included with surveillance forms. Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by IMT.	Vessel Observers	☐
	Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick) to the IMT within 60 minutes of completing vessel surveillance.	Initial reports to the IMT may be verbal (followed by written transmission) if the vessel is out of range or has no facilities for transmitting forms.	Vessel Master and/or On-Scene Commander	☐
Ongoing actions	Review surveillance information to validate spill fate and trajectory.	-	Planning Section Chief / GIS	☐
	Use available data to conduct operational NEBA and confirm that pre-identified response options are appropriate.	-	Environment Unit Leader	☐
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required.	Surveillance data are useful in updating the Common Operating Picture in the IMT.	Planning Section Chief	☐

Table 10-3: Vessel surveillance resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Contracted vessels and VOOs	Santos-contracted vessel providers VOOs identified through AIS vessel tracking	Availability depends on Santos and vessel contractor activities	Vessels mobilised from Darwin, Varanus Island (VI), Exmouth or offshore location Locations verified through AIS vessel tracking software	Pending availability and location. Expected within 12 hours.

Table 10-4: Vessel surveillance – first-strike response timeline

Task		Time from IMT call-out
IMT begins sourcing Santos-contracted vessel or VOO for on-water surveillance		<90 minutes
VOO on site for surveillance		<48 hours (daylight dependent)
Minimum resource requirements		
One vessel. No specific vessel or crew requirements.		
Approximate steam time		
Deployment location	**Approximate distance to operational area[29] (nm)**	**Approximate steam time[30] (hours)**
Darwin	200	20
Broome	750	75

[29] *As measured to geometric centre point of operational area*
[30] *At average rate of 10 knots*

10.2 Aerial surveillance

Table 10-5 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 10-5: Aerial surveillance – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making		
Initiation criteria	Notification of a Level 2/3 spill		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓	✓	✓
Termination criteria	• Aerial surveillance undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable, OR • As directed by the relevant Control Agency		

Aerial surveillance is used to record the presence and size of the hydrocarbon spill at surface as well as other environmental observations including weather conditions, marine fauna and sensitive receptors in the area. Aerial surveillance provides superior coverage over vessel surveillance for estimating the spatial extent of a spill but is generally required only for larger Level 2/3 spills.

10.2.1 Implementation guidance

Table 10-6 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 10-7 lists resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial aerial surveillance operations are listed in Table 10-8. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 10-21 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-6: Implementation guidance – aerial surveillance

Action		Consideration	Responsibility	Complete
Initial actions	Contact contracted aviation provider – provide details of incident and request mobilisation to spill site for initial surveillance	If aviation asset is available near spill location, use where possible to gather as much information about the spill. If aviation asset is not available at spill location, IMT is to seek available resources through existing contractual arrangements. The initial surveillance flight may not include a trained aerial surveillance observer. Initial flights can be conducted using a standard crew—initial surveillance should not be delayed waiting for trained personnel. Ensure all safety requirements are met before deployment. During initial surveillance, attempt to obtain this data: • name of observer, date, time, aircraft type, speed and altitude of aircraft • location of slick or plume (global positioning system [GPS] positions, if possible) • spill source • size of the spill, including approximate length and width of the slick or plume • visual appearance of the slick (e.g. colour) • edge description (clear or blurred) • general description (windrows, patches etc.) • wildlife, habitat or other sensitive receptors observed • basic metocean conditions (e.g. sea state, wind, current) • photos/videos.	Operations Section Chief Logistics Section Chief	☐
	Source available Santos aerial observers, arrange accommodation/logistics and deploy to FOB/airbase location	Santos aerial observer list available from First-strike Resources on Santos' ER SharePoint page	Operations Section Chief Logistics Section Chief	☐
	Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation operations. Expected that 2 overpasses per day of the spill area are completed.	Flight plan to confirm with OSC that aircraft are permitted in the vicinity of the spill. Flights are only to occur during daylight and in weather conditions that do not pose significant safety risks.	Operations Section Chief / Aviation Superintendent	☐
	Pre-flight briefing	-	Aerial Observers Contracted aircraft provider / pilots	☐
	Aerial observers to commence surveillance	Consider procedure for interacting with marine fauna	Operations Section Chief	☐

Action		Consideration	Responsibility	Complete
	Determine spill extent by completing Aerial Surveillance Log (Appendix F) and Aerial Surveillance Surface Slick Monitoring Template. Calculate volume of oil (Appendix G). Take photos and/or video of the slick.	Thickness estimates are to be based on the BAOAC (refer to Appendix F)	Aerial Observer	☐
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (Appendix H)	Provide a copy of completed Record Sheets to OSM Management Team / Monitoring Branch	Aerial Observer	☐
	Record shoreline habitat type and degree of oiling by completing the Aerial Surveillance Shoreline Observation Log (Appendix I)	Thickness estimates are to be based on the BAOAC (refer to Appendix F)	Aerial Observer	☐
	Relay all surveillance records: logs, forms, photos, videos to the IMT	Where possible, consider providing a verbal report of relevant information via radio/telephone en route if the aircraft has long transits from the spill location to base	Aerial Observer Planning Section Chief Operations Section Chief	☐
Ongoing actions	Update flight schedule for ongoing aerial surveillance as part of broader Aviation Sub-plan of IAP	Frequency of flights should consider information needs of IMT to help maintain the Common Operating Picture and determine ongoing response operations	Operations Section Chief / Aviation Superintendent Planning Section Chief	☐
Ongoing actions	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities	-	Logistics Section Chief	☐
Ongoing actions	Update Common Operating Picture with surveillance information and provide updates to spill trajectory modelling provider	-	Planning Section Chief GIS Team Leader	☐

Table 10-7: Aerial surveillance resource capability

Equipment type / personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Rotary-wing aircraft and flight crew	Santos-contracted provider/s	2 contracted (1 primary + 1 backup) + additional as required	Darwin Karratha	Wheels up within 1 hour for ER Spill surveillance <10 hours (daylight dependent)
Aerial surveillance crew	Santos-trained aerial observers	7 Santos staff	Perth and VI (Santos aerial observers)	24 hours – available from Day 2 of the incident
	AMOSC / industry mutual aid	4 AMOSC staff 2 AMOSC Core Group personnel available Additional trained industry mutual aid personnel	Australia-wide	24 hours – available from Day 2 of the incident
Drones and pilots ** secondary response to assist vessel-based surveillance	AMOSC	Drones available 24/7 through AMOSC sub-contract 1 pilot	Fremantle	Response via Duty Officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment mobilisation times vary according to stockpile location (refer to Table 10-12)
	OSRL – third-party unmanned aerial vehicle (UAV) provider	2 qualified remote pilots; however, response is on best endeavours basis	Australia / international	Depends on port of departure, 1–2 days if within Australia
	Local WA hire companies	10+	Perth and regional WA	-

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Table 10-8: Aerial surveillance – first-strike response timeline

Task		Time from IMT call-out
Aircraft activated for aerial surveillance		<3 hours
Aircraft on site for aerial surveillance		<10 hours (daylight dependent)
Trained aerial observers mobilised to airbase (Darwin)		<24 hours (daylight dependent)
Minimum resource requirements		
• Santos-contracted helicopter and pilots (based in Darwin) • Santos-trained aerial observers		
Approximate flight time		
Airport	**Approximate distance[31] (nm)**	**Approximate flight time[32] (hours: minutes)**
Darwin	180	1:30
Broome	700	6:00

[31] *As measured to geometric centre point of operational area*

[32] *At average flight speed of 120 knots*

10.3 Tracking buoys

Table 10-9 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 10-9: Tracking buoys – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making		
Initiation criteria	Notification of a Level 2 or 3 spill May be deployed for a Level 1 spill if deemed beneficial by the OSC		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓	✓	✓
Termination criteria	• Tracking buoy deployment will continue for 24 hours after the source is under control and a surface sheen is no longer observable, OR • As directed by the relevant Control Agency		

10.3.1 Implementation guidance

Table 10-10 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 10-11 lists resources that may be used to implement this strategy. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented. Table 10-21 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-10: Implementation guidance – tracking buoys

	Action	Consideration	Responsibility	Complete
Initial actions	Organise vessel to mobilise 2 tracking buoys from support vessel	Personnel and vessel safety is the priority Current Santos on-hire vessels or VOOs can be used. AIS vessel tracking is available through Santos' ER SharePoint page	OSC / Operations Section Chief	☐
	Deploy 2 tracking buoys at leading edge of slick	Note deployment details and weather conditions in incident log	Vessel Master	☐
	Inform IMT that tracking buoys have been deployed and provide deployment details Monitor movement of tracking buoys	Tracking buoy monitoring website on Santos' ER SharePoint site	OSC Planning Section Chief / GIS	☐
	Use tracking buoy data to maintain Common Operating Picture in the IMT	Data tracked online	Planning Section Chief / GIS	☐
	Relay information to spill fate modelling supplier for calibrating trajectory modelling	-	Planning Section Chief / GIS	☐
Ongoing actions	Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations	IAP to provide guidance regarding any additional tracking buoy deployments	Planning Section Chief	☐
	Mobilise additional tracking buoys if required from other Santos operations (As at July 2024, Santos has 12 tracking buoys located on the NWS) or from AMOSC stockpiles	-	Logistics Section Chief	☐
	Organise vessel to deploy additional tracking buoys if required	For continuous releases over multiple days, use rolling deployment/collection of tracking buoys to provide better coverage of plume direction	Operations Section Chief	☐
	Deploy tracking buoys	-	Vessel Master	☐
	Monitor movement of tracking buoys	-	Planning Section Chief /GIS	☐
	Relay information to spill trajectory modelling supplier for calibrating trajectory modelling	-	Planning Section Chief /GIS	☐

Table 10-11: Tracking buoy resource capability

Equipment type / personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Tracking buoys	Santos	2	FPSO *BW Opal*	<2 hours for incident
		2	Darwin	<24 hours to site pending vessel availability
		4	Dampier	Dampier/VI buoys – 48–72 hours to site depending on vessel availability
		4	VI	
AMOSC tracking buoys	AMOSC	4	Fremantle	Response via duty officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location (refer to Table 10-12).
		4	Geelong	

Table 10-12: AMOSC equipment mobilisation timeframes

	Perth	Darwin	Dampier
Geelong (Victoria)	40 hours / 3,395 km	44 hours / 3,730 km	70 hours / 4,840 km
Perth	N/A	48 hours / 4,040 km	19 hours / 1,530 km
Exmouth	15 hours / 1,250 km	38 hours / 3,170 km	7 hours / 555 km
Broome	27 hours / 2,240 km	22 hours / 1,870 km	11 hours / 855 km

Table 10-13: Tracking buoy – first-strike response timeline

Task	Time from IMT call-out
Tracking buoys deployed from support vessels	<2 hours
OR	
Tracking buoys deployed from Darwin using VOOs	24 hours to site, depending on vessel availability
Minimum Resource Requirements	
2 tracking buoys for initial deployment	

10.4 Oil spill trajectory modelling

Table 10-14 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 10-14: Oil spill trajectory modelling – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making		
Initiation criteria	Notification of a Level 2 or 3 spill		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓	✓	✓
Termination criteria	• Spill fate modelling will continue for 24 hours after the source is under control and a surface sheen is no longer observable, or until no longer beneficial to predict spill trajectory and concentrations, OR • As directed by the relevant Control Agency		

Oil spill trajectory modelling uses computer modelling (e.g. OILMAP, SIMAP) to estimate the movement, fate and weathering potential of spills. Santos has engaged RPS Group to provide forecast spill fate modelling. RPS Group use SIMAP and OILMAP modelling systems that comply with Australian Standards (ASTM Standard F2067-22 ‘Standard Practice for Development and Use of Oil Spill Trajectory Models’). RPS Group also provide the capacity for forecast air quality monitoring to assess potential health and safety risks associated with VOCs released from a surface slick.

A particular advantage of spill trajectory modelling is that the transport and weathering of spilled hydrocarbons can be forecast—at all times of the day and night, at any location, and under any type of metocean conditions. By contrast, aerial surveillance and vessel-based monitoring are constrained to daytime use and are limited by the operating environment. However, aerial surveillance and vessel-based monitoring are essential for model validation, verification and calibration of any modelling or initial surveillance predictions.

10.4.1 Implementation guidance

Table 10-15 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 10-16 lists resources that may be used to implement this strategy. The Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 10-21 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-15: Implementation guidance – oil spill trajectory modelling

Action		Consideration	Responsibility	Complete
Initial actions	Initiate oil spill trajectory modelling (OSTM) by submitting an oil spill trajectory modelling request form (Santos' ER SharePoint). Request 3-day forecast trajectory modelling	-	Environment Unit Leader	☐
	Determine requirement for gas/VOC modelling and request initiation	Hydrocarbon releases have human health and safety considerations for responders (VOCs). This to be considered for any tactics that monitor/recover oil, especially close to the release site	Safety Officer Environment Unit Leader	☐
	Operational surveillance data (aerial, vessel, tracking buoys) to be given to modelling provider to verify and adjust fate predictions of the spill and improve predictive accuracy	-	Planning Section Chief /GIS	☐
	Log in to the RPS Group data sharing website and maintain connection. Download modelling results	Data should be stored digitally and backed up onto independent digital storage media. All datasets should be accompanied by a metadata summary and documented quality assurance and control procedures	Planning Section Chief /GIS	☐
	Place RPS Group modelling data into GIS/Common Operating Picture	RPS Group to provide at least daily updates to the IMT of trajectory model outputs to inform response planning. More frequent updates can be provided if weather conditions are highly variable or change suddenly	Planning Section Chief /GIS	☐
	If chemical dispersants are considered an applicable strategy for spill scenario, request modelling provider to model how dispersant addition affects the distribution and concentration of floating oil, subsea oil and shoreline loading	Planning and Operations to provide inputs for modelled simulation based on potential/planned dispersant operations Outputs from dispersant addition modelling to inform NEBA	Planning Section Chief Operations Section Chief	☐
	Identify location and sensitivities at risk (based on the trajectory modelling) and inform IMT. Conduct operational NEBA on proposed response strategies	-	Environment Unit Leader	☐
Ongoing actions	Request spill trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture in the IMT		Planning Section Chief / GIS	☐
	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input data (if or when available) to improve model accuracy	-	Planning Section Chief / GIS	☐

Table 10-16: Oil spill trajectory modelling resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
RPS oil spill trajectory (OST) modellers and software	RPS under direct contract to Santos, also available through AMOSC	Daily OSTM reports	Perth – digital	2–4 hours from activation

Table 10-17: Oil spill trajectory modelling – first-strike response timeline

Task	Time from IMT call-out
RPS OSTM activated by IMT	<2 hours
OSTM provided to IMT	<4 hours
Minimum resource requirements	
• Contracted OST modellers and software • OSTM Activation Form	

10.5 Satellite imagery

Table 10-18 lists the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-18: Satellite imagery – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics to provide situational awareness to inform IMT decision-making		
Initiation criteria	Notification of a Level 2 or 3 spill		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓	✓	✓
Termination criteria	Satellite monitoring will continue until no further benefit is achieved from continuing; or as advised by relevant Control Agency.		

Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response; use is at the discretion of the IMT.

Suitable imagery may be available via satellite imagery suppliers. This can be done through existing AMOSC and OSRL contracts. The most appropriate images for purchase will be based on the extent and location of the oil spill. Synthetic aperture radar and visible imagery may both be of value. Availability of satellite images for a specific location will depend on several factors including satellite current position and availability/tasking, and weather conditions (e.g. cloud cover obscures images).

10.5.1 Implementation guidance

Table 10-19 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 10-20 lists resources that may be used to implement this strategy. The Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 10-21 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-19: Satellite imagery implementation guide

Action		Consideration	Responsibility	Complete
Initial actions	Assess requirement for satellite imagery	-	Planning Section Chief	☐
	Notify AMOSC and OSRL Duty Officer to initiate request for available satellite imagery	Formal written activation of resources from AMOSC and OSRL by designated call-out authorities (Santos Duty Managers/Incident Commanders) is required	Planning Section Chief	☐
	Assess suitability and order imagery	-	Planning Section Chief	☐
	Integrate satellite imagery into Common Operating Picture in the IMT and provide to trajectory modelling provider for model validation	-	GIS Team Leader Planning Section Chief	☐
Ongoing actions	Review surveillance information to validate spill fate and trajectory	-	Planning Section Chief	☐
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required	Use surveillance data when updating the Common Operating Picture in the IMT	Planning Section Chief	☐

Table 10-20: Satellite imagery resource capability

Equipment type / personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Satellite Imagery	KSAT – activated through AMOSC MDA – activated through OSRL	Depends on overpass frequency (to be confirmed on activation)	Digital	If satellite images are required, Santos to notify provider within 12 hours

10.6 Environmental performance

Table 10-21 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 10-21: Environmental performance – monitor and evaluate

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision-making		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
Monitor and evaluate – vessel and aerial surveillance	**Response preparedness**		
	Maintenance of master service agreements (MSAs) with multiple vessel providers for surveillance vessel capability	[EPS-ME-001] Santos maintains MSAs with multiple vessel providers as specified in Table 10-3.	MSAs with vessel providers
	Minimum specifications list for surveillance vessels	[EPS-ME-002] Maintain minimum specifications list for surveillance vessels to aid in rapid vessel selection	Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Track location of potential surveillance vessels	[EPS-ME-003] Santos maintains access to Automatic Identification System (AIS) Vessel Monitoring System to track potential surveillance vessel locations	AIS live tracking portal
	MSA with aviation supplier for aerial surveillance capability	[EPS-ME-009] MSA in place with helicopter/aircraft provider throughout activity	MSA with aviation supplier
	Trained aerial observers available through Santos personnel	[EPS-ME-010] Santos maintains a pool of trained aerial observers	Exercise records Training records
	Trained aerial observers available through mutual aid arrangements facilitated by AMOSC	[EPS-ME-011] Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to trained aerial observers	AMOSC Participating Member contract
	Access to certified UAV providers	[EPS-ME-012] Maintenance of contract for access to UAV providers	List of certified UAV providers AMOSC Participating Member contract OSRL Associate Member contract
	Aircraft charter companies for fauna observations	[EPS-ME-013] Maintain a list of aircraft charter companies that could potentially provide fauna observation services	List of providers
	Response implementation		
	Vessel surveillance first-strike capability mobilised	[EPS-ME-004] First-strike is mobilised in accordance with details and timings as specified in Table 10-4	Incident log

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision-making		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
	Vessel surveillance daily observation reports	[EPS-ME-007] Daily observation reports submitted to IMT until termination criteria are met	Incident log
	Vessels and chartered surveillance aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	[EPS-ME-006] Vessels comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003), which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000, which includes controls for minimising the risk of collision with marine fauna	Vessel contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure Completed vessel statement of conformance
		[EPS-ME-014] Chartered surveillance aircraft comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003), which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000, which includes controls for minimising interaction with marine fauna	Aircraft contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure
	Aerial surveillance first-strike capability mobilised	[EPS-ME-015] First strike is mobilised in accordance with details and timings as specified in Table 10-8	Incident log
	Aerial surveillance – 2 passes per day	[EPS-ME-016] Following initiation of aerial surveillance, 2 passes per day of spill area by observation aircraft provided	Incident log IAP
	Aerial surveillance trained aerial observers	[EPS-ME-017] Trained aerial observers supplied from day 2 of response	Incident log
	Aerial surveillance flight schedules	[EPS-ME-019] Flight schedules are maintained throughout response	IAP
	Aerial surveillance observer log	[EPS-ME-020] Observers completed aerial surveillance observer log following completion of flight	Completed Aerial Surveillance Observer Logs
Monitor and evaluate – tracking buoys	**Response preparedness**		
	Tracking buoys available	[EPS-ME-023] Maintenance of 12 tracking buoys throughout the activity	Computer tracking software Tracking buoy tests
	Response implementation		
	Tracking buoy first-strike capability mobilised	[EPS-ME-024] First strike is mobilised in accordance with details and timings as specified in Table 10-11	Incident log
Monitor and evaluate – oil spill modelling	**Response preparedness**		
	Maintenance of contract for emergency response modelling	[EPS-ME-027] Maintenance of contract for forecast spill trajectory modelling services throughout activity	Modelling services contract

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision-making		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
	Maintenance of access to additional emergency response modelling	[EPS-ME-028] Access to additional spill modelling capability to ensure redundancy	Membership in place with OSRL
	Response implementation		
	Oil spill modelling provider first contact	[EPS-ME-029] Oil spill modelling provider will be contacted within 2 hours upon notification of a Level 2 or 3 spill	Incident log
	Oil spill modelling provider output minimum timings	[EPS-ME-030] Modelling delivered to IMT within 2 hours of request to service provider	Incident log
Monitor and evaluate – satellite imagery	**Response preparedness**		
	Satellite imagery and analysis capability	[EPS-ME-032] Satellite imagery and analysis accessed through third-party provider activated through AMOSC and/or OSRL	AMOSC Participating Member contract OSRL Associate Member contract
	Response implementation		
	Satellite imagery and analysis provided to IMT	[EPS-ME-033] Data incorporated into Common Operating Picture and provided to spill modelling provider	Incident log IAP

11. Containment and recovery plan

Table 11-1 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 11-1: Containment and recovery – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement containment and recovery tactics to reduce the volume of surface hydrocarbons to reduce contact with protection priorities		
Initiation criteria	Notification of a Level 2/3 spill		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✗	✓ 2	✗
Termination criteria	• NEBA is no longer being achieved, and • Agreement is reached with Jurisdictional Authorities to terminate the response		

11.1 Overview

Containment and recovery (C&R) involves using booms and skimming equipment to create physical barriers on the water surface to contain and recover the oil and remove the risk of oil contacting environmental, social and cultural sensitivities. This strategy is often used in the offshore environment near the hydrocarbon source. Once contained (using a boom), an attempt to recover the hydrocarbons from the surface waters can be undertaken using a skimmer.

Spill modelling predicted very limited opportunity to conduct C&R, with the HFO spill (surface release of HFO from the offtake tanker - 460 m^3 released over 1 hour)) deterministic modelling (run 83) predicting 0 km^2 of floating oil ≥50 g/m^2 by the end of day 2, and only limited areas of oil thickness ≥50 g/m^2 before this time (maximum of 5 km^2 on day 0) (RPS, 2023) (refer to Section 6.4) . Therefore, C&R is a secondary response strategy that may be considered at the time of a spill based on the criteria outlined in Table 11-2. Further definition of BAOACs is provided in Table 13-2.

Table 11-2: Containment and recovery application criteria

Criteria	Recommended	Not Recommended
Spill characteristics	• Patchy slick • Extended operations • Surface concentrations ≥50 g/m² (BAOAC of 4) at a minimum, 200 g/m² (BAOAC of 4/5) is optimal	• Situation dependent • Surface thickness <50 g/m² (BAOAC <4)
Hydrocarbon type	• Group 3 hydrocarbons and above • Persistent components of Group 1 and 2 hydrocarbons may be suitable	• Minor to moderate spills of Group 1 and 2 hydrocarbons are likely to weather rapidly. High volatiles of these hydrocarbons may be a safety risk to personnel
Operating environment	• Waves <1 m for nearshore containment and recovery systems(e.g. Santos Expandi Boom) • Waves <1.8 m for offshore systems • Winds <20 knots	• Wave heights >1.8 m • Current >0.75 knots

11.2 Implementation guidance

Table 11-3 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 11-4 lists resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial C&R operations are listed in Table 11-5. The Incident Commander is ultimately responsible for the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

11.3 Resourcing requirements

To help determine the likely encounter rate from C&R operations, the Boom Encounter Rate Formula in AMSA's Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA, 2023) was used.

Boom Encounter Rate (BER) Formula =

(length of boom [LB] × 0.3) × velocity of vessel (knots/hour) × thickness of slick (mm)

where:

- LB = assumed as 200 m (based on typical available boom lengths of 200 m)
- velocity = 1 knot
- thickness of slick = 50 g/m² (or 0.047 mm)
- Note: percentage cover is assumed to be 100% during initial stages of the operation

BER = (200 × 0.3) × 1 × 0.047 = 2.82 m³ per operation per hour, × 12 hours of operation
= **33 m³ / operation / day**

Given that stochastic results from oil spill modelling indicate there is only limited floating oil ≥50 g/m² for the HFO spill scenario, C&R has only been included as a possible response strategy in case there are areas observed at suitable thickness, and as deemed beneficial by the operational NEBA.

For planning purposes, the resources available for an offshore C&R response have been assessed and were deemed more than sufficient.

A J-Sweep configuration (as shown in Figure 11-1) using 2 vessels (one deploying and one towing) is assumed for each C&R unit. Each C&R unit comprises:

- 2 vessel masters (deployment vessel and tow vessel)
- 1 supervisor
- 4 deployment crew
- 1 200 m offshore boom reel
- 1 offshore skimmer
- If required (if deployment vessel does not have integral recovered oil storage tanks): Waste storage of 33 m³ per day (comprising two 4 m³ offshore ISO (International Organisation for Standardisation) tanks stowed on deck, and one 25 m³ inflatable storage bladder towed alongside the deployment vessel).

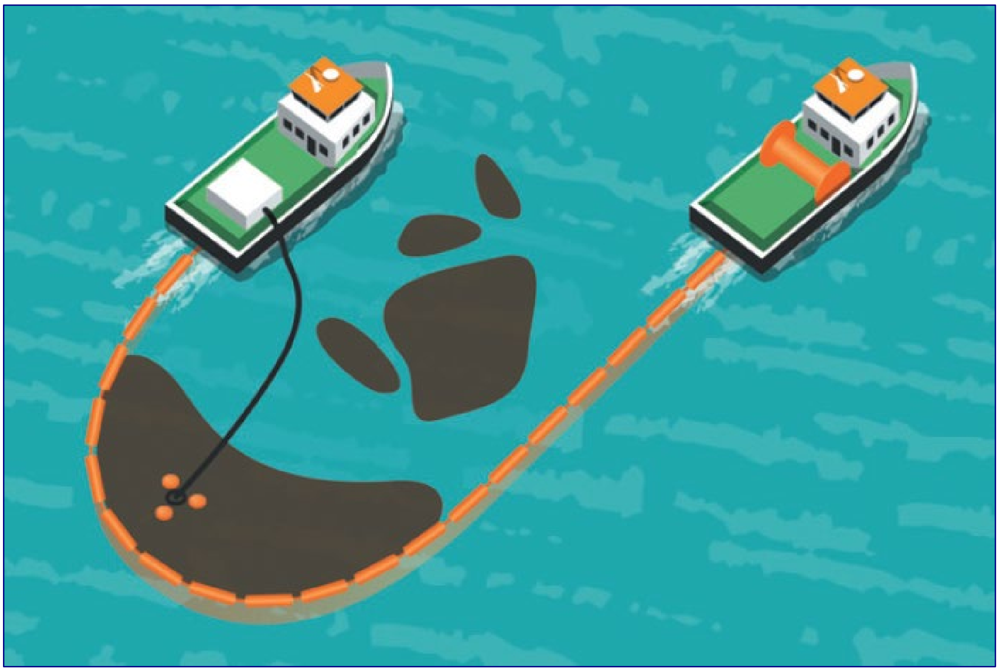

Figure 11-1: 'J' Configuration for containment and recovery operations; 1 containment and recovery unit (IPIECA-IOGP, 2016a)

The deployment vessel will be tasked to carry out the deployment of boom, skimmer and towable temporary storage bladder (if required), using the towing vessel for support. The vessel deck layout plan is shown in Figure 11-2. Using vessels of an appropriate specification is essential to ensure successful C&R operations. The required specifications for deployment and towing vessels are defined in the Santos Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001).

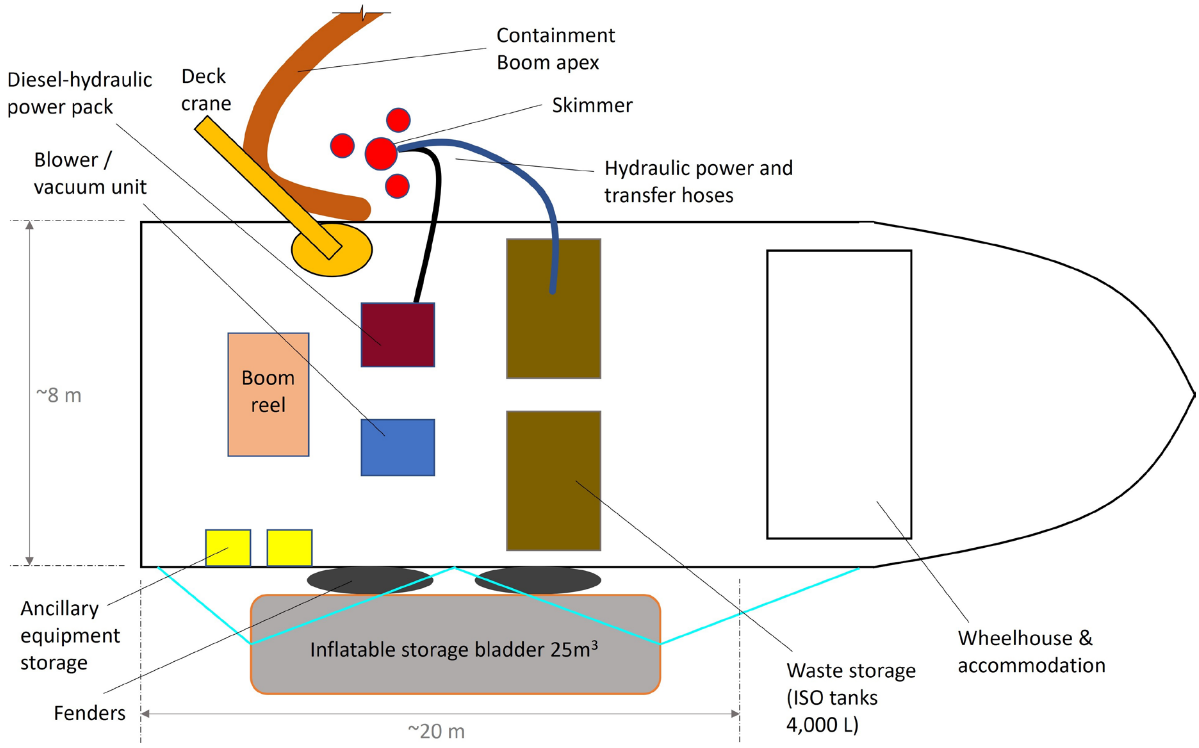

Figure 11-2: Containment and recovery vessel deck layout plan (OSRL, 2021)

Liquid waste collection, transport and final disposal of waste received at port will be through Santos' waste service provider (as detailed in Section 17.5).

For the purposes of resource planning for the Barossa Production Operations activity, it has been assumed that 1–2 C&R units may be used (if at all), given the very limited opportunity to apply C&R as predicted by the oil spill modelling (refer to Section 6.4). Personnel numbers for C&R are listed in Table Q-1 (Cumulative Response Capability Assessment) as part of the cumulative resourcing assessment in Appendix Q.

Table 11-3: Implementation guidance – containment and recovery

	Action	Consideration	Responsibility	Complete
Initial Actions	**Containment and recovery**			
	Identify and activate containment and recovery equipment stockpiles based on incident location Initial equipment mobilisation from Darwin	Refer to Table 11-4 for location of C&R resources Initial deployment from Darwin pending vessel availability Up-to-date stockpile information accessed through Santos' ER SharePoint site	Logistics Section Chief Supply Unit Leader Operations Section Chief	☐
	Identify suitable deployment vessels/crew Mobilise resources to port location – Darwin	Refer to Table 11-4 for location of C&R resources Initial deployment from Darwin depending on vessel availability Preference will be for vessels and crew that are used in regular Santos booming exercises	Logistics Section Chief Supply Unit Leader Operations Section Chief	☐
	Assess the spill trajectory modelling and other operational monitoring data to identify operational area for C&R deployments	Refer to Table 11-2 for guidance	Operations Section Chief Planning Section Chief	☐
	Confirm conditions are suitable for C&R activities	Refer to Table 11-2 for guidance	Operations Section Chief Planning Section Chief	☐
	Mobilise deployment personnel to nominated marine base(s)	Each unit conducting C&R is to be staffed with a trained AMOSC, Santos or OSRL Oil Spill Responder positioned on the deployment vessel, who is the Team Leader tasked with controlling the operations and implementing them safely and responsibly. The Team Leader is responsible for evaluating the effectiveness of the C&R operations and communicating the information to the IMT Operations Section Chief.	Operations Section Chief Logistics Section Chief	☐
	Coordinate aerial surveillance support to vessels to ensure they are being directed to priority locations for C&R activities within operational zones	Focus on C&R activities to areas of slick of a sufficient thickness whereby C&R activities will be effective Refer to Table 11-2 for guidance	Planning Section Chief Operations Section Chief	☐
	Direct C&R operations to designated operational zones	-	Operations Section Chief	☐
	Decanting (if selected)			
	Obtain decanting approval from AMSA (Commonwealth waters), NT Control Agency (NT waters) or WA DoT (WA waters)	Under both MARPOL and *Pollution of Waters by Oils and Noxious Substances Act 1987* (WA; POWBONS), decanting must be approved by the relevant Jurisdictional Authority where the discharge will occur. Approval should be sought to discharge water that has separated from oil into the apex of the already deployed containment boom system (with operational skimmer). This will increase the oil storing capacity of storage tanks.	Environment Unit Leader	☐
	Ensure personnel onboard the vessels are familiar with the decanting procedure approved by the relevant authority	-	Operations Section Chief	☐

	Action	Consideration	Responsibility	Complete
	Commence decanting operations, ensuring that any discharged water is directed into the apex of the already deployed containment boom system (with operational skimmer)	-	Vessel Master/s	☐
	Ensure there is sufficient temporary storage for oily wastewater onboard vessel	-	Operations Team Leader	☐
Ongoing Actions	**Containment and recovery**			
	Coordinate the dispatch of operationally ready (all equipment and personnel on board) vessels via the IAP	Equipment will be maintained and replaced if necessary through existing stockpiles	Operations Section Chief	☐
	Maintain operational zones and provide updates to vessel masters on most suitable locations for C&R operations	Continue to use aerial surveillance data to inform the location of operational zones	Operations Section Chief	☐
	Develop waste transfer process to secondary vessels/barge to enhance C&R vessel operational time, reduce port visits for waste unloading and reduce contamination	Consider location and size/ type of waste collection vessel/barge and suitability of equipment and waste receptacles for dynamic lifts	Operations Section Chief Planning Section Chief Logistics Section Chief	☐
	Decanting (if selected)			
	Record volumes of all water decanted	This information must be supplied to the relevant Jurisdictional Authority	Vessel Master/s	☐
	Manage any solid wastes generated	-	Vessel Master/s	☐

Table 11-4: Containment and recovery – resource capability

Equipment type / personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
Recovery booms and skimmers	Santos	C&R boom (Current Buster / Expandi Boom) Comes with accessories and powerpacks Total – 6	Exmouth container – 3 boom systems and accessories VI container – 3 boom systems and accessories	VI deployment: Total of 7 days from VI to Barossa field ready to commence operations. Exmouth deployment: Total of 7.5 days from Exmouth to Barossa field ready to commence operations. Within 12 hours (for Exmouth- or VI-based deployment)
		Desmi DBD16 brush skimmer For inshore/calm seas deployment Comes with hoses/powerpacks Total – 2	Exmouth – 1 VI – 1	
	AMOSC	Desmi Ro-boom 1500–200 m offshore boom on hydraulic reel Total – 18	Exmouth – 2 Fremantle – 6 Geelong – 10	Response via Duty Officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment mobilisation times vary according to stockpile location[33] (refer to Table 10-12).
		NOFI Current Buster 2 boom system Total – 1	Geelong – 1	
		Desmi speed sweep system Total – 1	Geelong – 1	
		Skimmers – refer to Table 14-3		
	AMSA	Ro-boom (200 m) Total – 8	Karratha – 4 Fremantle – 4	Access to National Plan equipment[34] through AMOSC[35]. Equipment mobilisation times vary according to stockpile location.
		Lamor heavy-duty open water boom (200 m)	Darwin – 2	
		Vikoma 300 m Hi Sprint boom Total – 5	Karratha – 2 Fremantle – 2 Darwin – 1	
		NOFI Current Buster 4 boom system	Darwin – 1 Karratha – 1	
		Skimmers – refer to Table 14-3		

[33] *Updated AMOSC equipment listings are available through AMOSC Members Hub: https://amosc.sharepoint.com/sites/HUB/SitePages/CollabHome.aspx*

[34] *Updated AMSA equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal: https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[35] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources.*

Equipment type / personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
	Industry mutual aid equipment	Offshore boom and skimmers	WA/NT	Access to industry mutual aid through AMOSPlan and facilitated by AMOSC
	OSRL (Guaranteed access to 50% by type of equipment available. Additional access considered on a case-by-case basis)	37 Ro-boom (200 m) 2 Hi Sprint boom (300 m) 15 towing boom (Current Busters) 50 offshore recovery skimmers	Various – Singapore, UK, Bahrain, Fort Lauderdale (US)	Response via Duty Officer within 10 minutes of first call. Equipment mobilisation times vary according to stockpile location.
Offshore waste storage	AMOSC	Lancer barges (25 m^3 each) Total – 4	Fremantle –2 Geelong – 2	Response via Duty Officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment mobilisation times vary according to stockpile location (refer to Table 10-12).
		Deck bladders (25 m^3 each) Total – 6	Fremantle –3 Geelong – 3	
	AMSA	Vikoma flexidam (10 m^3 each) Total – 10	Fremantle –4 Karratha –4 Darwin – 2	Access to National Plan equipment through AMOSC. Equipment mobilisation times vary according to stockpile location.
		Canflex sea slug (10 m^3 each) Total – 6	Fremantle –3 Karratha – 2 Darwin – 1	
		Canflex sea slug (25 m^3 each) Total – 1	Darwin – 1	
		Canflex sea slug (50 m^3 each) Total – 1	Darwin – 1	
		Vikoma frost barge (25 m^3 each) Total – 5	Fremantle –2 Karratha – 2 Darwin – 1	
		Covertex tow tank (20 m^3 each) Total – 3	Karratha – 2 Darwin – 1	
	Via Santos-contracted waste service provider/s	Refer to Waste Management (Section 17) for details on Santos' waste service provider	Darwin Perth Karratha	<24 hours

Equipment type / personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
	OSRL (Guaranteed access to 50% by type of equipment available. Additional access considered on a case-by-case basis)	14 storage barges (50 m^3 each)	Various – Singapore, UK, Bahrain, Fort Lauderdale	Response via Duty Officer within 10 minutes of first call. Equipment mobilisation times vary according to stockpile location.
		21 storage barges (25 m^3 each)		
		9 waste containment tanks (10 m^3 each)		
		2 Sea slug (10 m^3 each)		
Offshore C&R deployment vessels, towing vessels and vessel crew Waste transfer vessels/barges for waste oil storage and transfer	Santos-contracted vessel providers. Preference for vessels used in Santos deployment exercises	Varies – check through vessel contractors / Santos vessel tracking system Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) provides the required vessel specifications	Exmouth, Dampier, NW locations, Singapore	Varies subject to location / availability
Personnel (field responders) for OSR strategies	AMOSC staff	12	Fremantle – 5 Geelong – 7	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel depends on location of spill and transport to site.
	AMOSC Core Group (Santos)	16	Perth / NW Australian facilities – 14	From <12 hours (NW-based personnel) From <24 hours (Perth personnel)
			Port Bonython (SA) – 2	<48 hours to NT locations
	Santos IMO1 personnel (Darwin)	6	Darwin	<24 hours to deployment port location
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility locations across Australia	Location dependent. Confirmed at time of activation.

Table 11-5: Containment and recovery – first-strike response timeline

Task	Time from IMT call-out
IMT confirms applicability of strategy and begins sourcing C&R resources for applicable spills	<4 hours
Santos Core Group and Darwin trained personnel mobilised to deployment port location	<24 hours
C&R equipment (offshore boom/skimmers) mobilised to deployment port	<24 hours
Waste storage equipment mobilised to port	<24 hours
Suitable C&R vessels mobilised to port	<24 hours
C&R trained personnel mobilised to deployment port	<24–48 hours
C&R operation deployed to spill site (weather/daylight dependent)	<60–72 hours (weather/daylight dependent)
Minimum resources per C&R unit	

• 2 suitable C&R vessels (1 deployment vessel + 1 tow vessel) – refer Santos Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) for vessel specifications
• 200 m of offshore boom
• 1 offshore skimmer appropriate to hydrocarbon type and operating conditions
• Waste storage (comprising a combination of towable bladder, IBCs, ISO tanks, inbuilt vessel storage tanks allowing for 33 m^3 liquid waste volume storage per C&R unit)
• Personnel:
  – 2 vessel masters (deployment vessel and tow vessel)
  – 1 trained responder
  – 4 deployment crew
• PPE	

11.4 Decanting

Decanting is an important tool that makes efficient use of waste management resources, which are often a limiting factor in C&R.

In some circumstances, reducing overall waste can create an environmental benefit that outweighs the minimal impact caused by the release of water with very low concentrations of oil.

Section 8 of the *Pollution of Waters by Oils and Noxious Substances (POWBONS) Act 1987* (WA) allows for decanting for combating specific pollution incidents. Additionally, Annex 1 of MARPOL (Regulation 9) allows for decanting for combating specific pollution events to minimise the damage from pollution. Under both MARPOL and POWBONS, decanting must be approved by the relevant Jurisdictional Authority. In NT waters this is the NT Control Agency, in WA State waters this is WA DoT (as the HMA under the *Emergency Management Act 2005*) and in Commonwealth waters this is AMSA. Approval will be sought if decanting is required.

If decanting approval is not obtained through the relevant Jurisdictional Authority, the complete collected oil and water will remain in the collection tanks, and all will be treated as collected waste. In this event, the duration of C&R operations may be reduced due to restricted available ullage.

11.5 Environmental performance

Table 11-6 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 11-6: Environmental performance – containment and recovery

Environmental performance outcome	Implement containment and recovery tactics to reduce hydrocarbon contact to surface and shoreline priority protection areas		
Response strategy	**Control measures**	**Performance standard [EPS ID]**	**Measurement criteria**
Offshore C&R	**Response preparedness**		
	Access to Santos C&R equipment and personnel	[EPS-CR-001] Santos personnel and equipment stored and maintained / available as per Table 11-4	Santos oil spill response team database Santos equipment register Exercise reports
	Access to C&R equipment and personnel	[EPS-CR-002] Maintenance of access to containment and recovery equipment and personnel through AMOSC, AMSA National Plan, OSRL and TRG throughout activity as specified in Table 11-4	Access to National Plan resources through AMSA AMOSC Participating Member contract OSRL Associate Member contract TRG arrangements
	Offshore waste transfer concept of operations in place	[EPS-CR-004] Offshore waste transfer concept of operations to help maximise waste storage availability for containment and recovery vessels	Waste transfer concept of operations (within Santos Vessel Requirements for Oil Spill Response [7710-650-ERP-0001]).
	Vessel capability for C&R operations	[EPS-CR-006] Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	C&R vessel requirements are identified	[EPS-CR-005] Maintenance of vessel specification for offshore containment and recovery vessels and waste storage and transport vessels	Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Response implementation		
	First-strike capability mobilised	[EPS-CR-007] First strike is mobilised in accordance with details and timings as specified in Table 11-5	Incident Log
	Aerial surveillance information to direct operations to areas with greatest oil concentration	[EPS-CR-011] Aerial surveillance reports communicated to containment and recovery team leaders	Incident Log
	Decanting to maximise waste storage whilst minimising environmental impact and adhering to State and Commonwealth legislation	[EPS-CR-008] Decanting operation not to commence until approved. Application for offshore decanting is made to AMSA (Commonwealth waters) or NT/DoT (Territory/State waters). Decanting of collected water by returning to boom apex collection area, to maximise waste storage	Incident Log
	Prepare operational NEBA to determine if C&R activities are likely to result in a net environmental benefit	[EPS-CR-012] Records indicate operational NEBA completed prior to containment and recovery activities commencing NEBA will consider the oil thickness and weather constraints as key factors Operational NEBA to be undertaken each operational period	Incident Log IAP

12. Mechanical dispersion

Table 12-1 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 12-1: Mechanical dispersion – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	To create mixing for oil and water to enhance natural dispersion		
Initiation criteria	Monitor and Evaluate data identifies thin oil patches at the sea surface that are not naturally dissipating in sea surface and are posing risks to wildlife and shorelines by remaining on the surface		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓ 2	✗	✓ 2
Termination criteria	• There is no longer a noticeable reduction of surface oil resulting from the activity, or • NEBA is no longer being achieved, or • Unacceptable safety risks associated with gas and VOCs at the sea surface, or • Agreement is reached with Jurisdictional Authorities to terminate the response		

12.1 Overview

This response strategy assists with the natural dispersion process—it creates mixing through physical agitation by using a vessel's propellers and wake, which encourages the oil to break into smaller particle sizes that are more easily biodegraded. The 2 common activities associated with mechanical dispersion are:

- manoeuvring a vessel through the slick, using propeller wash and vessel wake to create mixing in the water body
- spraying water from the vessel's fire hose and moving the vessel through the water body to create additional mixing and breakup of the slick.

12.2 Implementation guidance

Table 12-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 12-3 lists resources that may be used to implement this strategy. The OSC / Vessel Master and/or Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 12-2: Implementation guidance – mechanical dispersion

Action		Consideration	Responsibility	Complete
Initial actions	The operational NEBA will confirm the suitability and environmental benefit of conducting mechanical dispersion at appropriate locations	Water depth and sea state Possible impacts to sensitive shorelines and/or wildlife This activity is to be conducted during daylight hours only and requires a safety plan to be developed before implementation	Operations Section Chief Environment Unit Leader Planning Section Chief	☐
	Safety Officer to develop a safety plan for the activity with respect to potentially dangerous gases and VOCs (including applicable controls)	Ambient gas testing during condensate spills providing safe levels for operation of personnel and vessels	Operations Section Chief Safety Officer	☐
	Notify vessel-based responders to trial mechanical dispersion	-	Operations Section Chief	☐
	Response personnel on vessels to evaluate the effectiveness of using mechanical dispersion operations to reduce the volume of oil on the water surface. Communicate the information to the IMT Operations Section Chief for inclusion in operational NEBA	-	Vessel Master/s Santos AMOSC Core Group Responders	☐

Table 12-3: Mechanical dispersion resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Vessels undertaking other activities Vessel(s) can be specifically contracted for the strategy if required (refer to Santos Vessel Requirements for Oil Spill Response document [7710-650-ERP-0001])	Santos-contracted vessel providers	Availability dependent upon Santos and vessel contractor activities	Vessels mobilised from Darwin; locations verified through AIS vessel tracking software	Varies subject to availability and location

12.3 Environmental performance

Table 12-4 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 12-4: Environmental performance – mechanical dispersion

Environmental performance outcome	To create mixing for oil and water to enhance natural dispersion		
Response strategy	**Control measures**	**Performance standard [EPS ID]**	**Measurement criteria**
Mechanical dispersion	**Response preparedness**		
	Mechanical dispersion capability in place	[EPS-MD-001] Mechanical dispersion capability in place based on Santos-contracted vessels availability	Existing MSAs with multiple vessel providers
	Response Implementation		
	Mechanical dispersion procedures in place to ensure safe and effective execution	[EPS-MD-002] Mechanical dispersion to be conducted as per the Mechanical Dispersion Plan	Mechanical Dispersion Plan IAP Incident Log
	Operational NEBA to determine net environmental benefit	[EPS-MD-003] Operational NEBA confirms suitability and environmental benefit	Incident Log IAP

13. Chemical dispersant application plan

Table 13-1 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 13-1: Chemical dispersant application – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities		
Initiation criteria	Notification of a Level 2/3 spill		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✗	✓ 2	✗
Termination criteria	• Application of chemical dispersants will cease when dispersant efficacy is no longer providing a net environmental benefit as assessed through the NEBA process, and • Agreement is reached with Jurisdictional Authorities to terminate the response		

13.1 Overview

Surface application of chemical dispersants is considered to be a secondary response strategy for HFO (refer to Section 6.4). Spill modelling predicted very limited opportunity for applying dispersant, with the HFO spill (surface release of HFO from the offtake tanker (460 m^3 released over 1 hour)) deterministic modelling (run 83) predicting 0 km^2 of floating oil ≥50 g/m^2 by the end of day 2, and only limited areas of oil thickness ≥50 g/m^2 before this time (maximum of 5 km^2 on day 0) (RPS, 2023) (refer to Section 6.4) . However, aerial surface dispersant application has been included as a secondary response strategy for the HFO spill scenario, in case smaller windows of thicker HFO (≥50 g/m^2) are observed after day 2.

Dispersants are chemicals that are sprayed onto floating oil slicks by vessels and/or aircraft, or injected subsea directly to the source of the spill (e.g. uncontrolled well loss site). Dispersants are designed to separate the oil into small droplets and assist with dispersion in the water column to speed up the process of natural biodegradation. Chemical dispersants can be used to:

- decrease the concentration and volume of surface oil reaching sensitive receptors
- increase the natural biodegradation rate
- reduce the quantity of waste created.

The operational NEBA process will consider potential impacts of both oil and dispersant on sensitive receptors, taking into account information gained from monitor and evaluate activities. This will inform decisions on dispersant use throughout the response, including application location(s), the volumes and rates at which dispersant is applied, and when to limit or stop dispersant use.

13.2 Surface chemical dispersants

Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50–100 g/m^2 on the sea surface. EMSA (2010) recommends thin layers of spilled hydrocarbons should not be treated with dispersant. This includes BAOACs 1 to 3 (EMSA, 2010) (Table 13-2). IPIECA (2015a) recommends that the thickest areas of oil should be targeted for effective surface dispersant application.

13.2.1 Dispersant application area

The base case for surface dispersant application is that no application is to occur within:

- a Habitat Protection Zone or National Park Zone of an AMP (application considered in the Multiple Use Zone)
- Territory/State Marine Parks
- Territory/State waters
- 10 km of water depths <10 m LAT
- safety exclusion zones of offshore facilities.

Table 13-2: Bonn Agreement Oil Agreement Appearance Codes

Code	Description	Layer thickness (μm)	Litres per km²
1	Silvery sheen	0.04 to 0.30	40 to 300
2	Rainbow sheen	0.30 to 5.00	300 to 5,000
3	Metallic	5 to 50	5,000 to 50,000
4	Discontinuous true oil colour	50 to 200	50,000 to 200,000
5	Continuous true oil colour	More than 200	More than 200,000

13.3 Vessel-based dispersant operations

For the purposes of resource planning for the Barossa Production Operations activity, it has been assumed that only 1–2 vessel dispersant systems may be used (if at all), given the very limited opportunity to apply dispersants as predicted by the oil spill modelling (refer to Section 6.4). Personnel resourcing numbers for vessel dispersant application are provided as part of the cumulative resourcing assessment in Appendix Q.

Table 13-3 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. Table 13-4 lists resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial vessel dispersant operations are listed in Table 13-5. The Incident Commander is ultimately responsible for the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 13-3: Implementation guidance – vessel dispersant application

Action		Consideration	Responsibility	Complete
Initial Actions	Confirm operational NEBA supports surface chemical dispersant application	Oil type suits dispersant application Surveillance to confirm oil spill thickness (e.g. BAOAC 4 to 5) supports use of dispersants from vessels Liaise with third-party providers (e.g. AMOSC) as part of operational NEBA. Evaluate oil spill trajectory modelling when available Guidance is provided as per AMSA guideline: Obtaining approval to use an oil spill control agent at sea or on a shoreline (AMSA, 2022)	Planning Section Chief Environment Unit Leader	☐
	For dispersant use in State waters – seek approval from WA DoT If dispersant use in Commonwealth waters could impact State waters, notify WA DoT	The WA DoT SMPC requests early notification if use of dispersant in Commonwealth waters could impact WA State waters. The NT Control Agency should also be notified if there is a risk of impact to NT waters (refer to Section 4.6.4)	Planning Section Chief	☐
	Activate Joint Industry OMP: Surface Chemical Dispersant Fate and Effectiveness Assessment via the OSM Services Provider (refer to Northern Australia OSM-BIP [7715-650-ERP-0003], Section 12)	Initiation criteria for OMP: Surface Chemical Dispersant Fate and Effectiveness Assessment is: • application of dispersant has been selected as a response option Therefore, this OMP requires immediate activation via the Northern Australia OSM-BIP (7715-650-ERP-0003), Section 12 Note: The 'shake test' assessment does not form part of OMP: Surface Chemical Dispersant Fate and Effectiveness Assessment and is usually performed as an initial assessment of dispersant efficacy	Planning Section Chief Environment Unit Leader	☐
	Source vessel/s for dispersant application and mobilise to nearest port for loading equipment and personnel (Darwin)	Vessel specification for dispersant vessels provided in Santos' ER SharePoint – First Strike Resources, and within Santos Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001)	Logistics Section Chief	☐
	Mobilise dispersant operations team leaders and team members (Santos Core Group and/or AMOSC staff/ Industry Core Group) to designated port	Each vessel undertaking dispersant application is to be staffed with personnel trained in dispersant application (e.g. AMOSC staff, Santos or Industry Core Group member) who is the team leader tasked with controlling the operations and implementing them safely and responsibly. For prolonged dispersant operations, OSRL responders via Singapore may also be used.	Logistics Section Chief	☐
	Mobilise vessel-based dispersant application equipment and dispersant shake test kits to the designated deployment port	Darwin Freight & Logistics to assist with local logistics, loading vessel spray systems, and dispersant movement	Logistics Section Chief	☐
	Mobilise AMOSC (Broome)/ AMSA (Darwin) dispersant stock to nominated vessel deployment location Darwin port	Check up-to-date dispersant stockpile inventories can be accessed via Santos' ER SharePoint – First Strike Resources	Logistics Section Chief	☐

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Action		Consideration	Responsibility	Complete
	Use aerial surveillance to determine priority areas for dispersant application and define operational area for response	Aerial surveillance reports of oil location and thickness	Planning Section Chief Operations Section Chief	☐
	Identify safety requirements and controls associated with spraying dispersants and working over oil	-	Safety Officer	☐
	Ensure shake jar test is conducted in-field to determine likely effectiveness of dispersant application and report results to IMT	Refer to NP-GUI-013: National Plan oil spill dispersant effectiveness field test kit operational guide, for guidance on how to conduct a dispersant field test	Operations Section Chief	☐
	First vessel on site is to test spray dispersant on the oil – confirm effectiveness	Effectiveness to be recorded with photos	Operations Section Chief	☐
	Confirm operational NEBA supports surface chemical dispersant application	Use monitor and evaluate data (i.e. forecast modelling), operational monitoring data and dispersant efficacy results in operational NEBA	Operations Section Chief Environment Unit Leader Planning Section Chief	☐
	If dispersant application is shown to be effective and approved for ongoing use by the Incident Commander, continue vessel operations and defining operational area	Use real-time or most recent visual surveillance observation data to develop operational zones for vessel dispersant operations. The base case restrictions for dispersant application are – no application within: • a Habitat Protection Zone or National Park Zone of an AMP (application considered in the Multiple Use Zone) • Territory/State Marine Parks • Territory/State waters • 10 km of water depths <10 m LAT • safety exclusion zones of offshore facilities The above applies unless justified otherwise by the operational NEBA. Note: No application is allowed in AMPs (outside Multi-use zone) or Territory/State waters without relevant authority approval (refer to Section 4.6.4 for the process on obtaining consent for dispersant use, and on notification to the relevant Control Agency of use in adjacent Commonwealth waters).	Operations Section Chief Incident Commander Environment Unit Leader Planning Section Chief	☐
	Monitor for efficacy using the Special Monitoring of Applied Response Technologies (SMART) Protocol (Section 13.6) as described in OMP: Surface Chemical Dispersant Fate and Effectiveness Assessment and provide results to the IMT	Initial monitoring is likely to only include Tier I (visual monitoring) of the SMART Protocol. Observers trained in visual observation techniques should be used	Operations Section Chief	☐

Action		Consideration	Responsibility	Complete
Ongoing Actions	Reassess dispersant use, using the NEBA process for each operational period. Stop application if no net environmental benefit	-	Operations Section Chief Incident Commander Environment Unit Leader Planning Section Chief	☐
	Continue to mobilise additional chemical dispersant stocks from AMOSC and AMSA	Worst-case requirements do not indicate OSRL dispersant stocks will be necessary but these are also available	Logistics Section Chief	☐
	Maintain operational zones and provide updates to vessel masters on most suitable locations for application	-	Operations Section Chief Environment Unit Leader Planning Section Chief	☐

Table 13-4: Vessel dispersant application – resource capability

Equipment type / personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Santos Vessel dispersant spray systems	Santos-owned	2 x containers (each c/w 3 x spray systems – dual arm, single arm & Afedo head)	Exmouth (Exmouth Freight & Logistics)	Mobilised to Exmouth port - within 12 hours of IMT request for dispersant resources.
AMOSC vessel dispersant spray system	AMOSC	1) Afedo spray systems 2) Viko Spray 3) Boom vane 4) Global dispersant spray system	1) Broome – 2; Exmouth – 1; Fremantle – 5; Geelong – 4 2) Exmouth – 1; Geelong – 2; Fremantle – 3 3) Fremantle – 1; Geelong – 1 4) Fremantle – 1	Response via duty officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call; for equipment mobilisation timeframes refer to Table 10-12
Industry mutual aid vessel dispersant spray system	Industry mutual aid	1 Afedo system 1 Kohler Arms spray system	Darwin	Access to industry mutual aid through AMOSPlan and facilitated by AMOSC
AMSA vessel dispersant spray system	AMSA	Ayles Fernie Boat Spray	Darwin – 2; Karratha – 2; Fremantle – 2	Access to National Plan equipment[36] through AMOSC[37] Equipment mobilisation times vary according to stockpile location.

[36] *Updated AMSA equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal: https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[37] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources*

Equipment type / personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Dispersant	AMOSC	Refer to Table 13-9		Response via duty officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call; for equipment mobilisation timeframes refer to Table 10-12
	AMSA	Refer to Table 13-9		Access to National Plan equipment through AMOSC. Equipment mobilisation times vary according to stockpile location.
Dispersant spray system vessels	Santos-contracted vessel providers Preference for vessels used in Santos deployment exercises	Varies – check through vessel contractors/ Santos vessel tracking system	Darwin	Varies subject to location / availability
Personnel (field responders)	AMOSC staff	12	Fremantle – 5 Geelong – 7	Response via duty officer within 15 minutes of first call; timeframe for availability of AMOSC personnel depends on location of spill and transport to site
	AMOSC Core Group (Santos)	16	Perth/NW Australian facilities – 14 Port Bonython (South Australia) – 2	From <12 hours (NW-based personnel) From <24 hours (Perth personnel) <48 hours to Exmouth (Perth-based personnel)
	Santos IMO1 personnel (Darwin)	6	Darwin	<24 hours to deployment port location
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility locations across Australia	Location dependent; confirmed at time of activation

Table 13-5: Vessel-based dispersant application – first-strike response timeline

Task	Time from IMT call-out
IMT confirms applicability of strategy and begins sourcing vessel dispersant resources for applicable spills	<3 hours
Suitable dispersant vessels mobilised to nearest deployment port (Darwin)	<12 hours
Santos Core Group and Darwin trained personnel mobilised to deployment port (Darwin)	<24 hours
Vessel spray system equipment mobilised to deployment port	<24 hours
Dispersants mobilised to port	<24 hours
Vessel spray operation commenced at spill site (weather/daylight dependent)	<60–72 hours (weather/daylight dependent)
Minimum resource requirements	
• Suitable dispersant application vessel – refer Santos ER SharePoint for vessel specification • 1 vessel dispersant spray system • Dispersant (10 m³) • 2 Santos Core Group or Industry Core Group responders • PPE	

13.4 Aerial dispersant operations

For the purposes of resource planning for the Barossa Production Operations activities, it has been assumed that only 2–3 aerial dispersant spray systems from AMOSC may be used (if at all), given the very limited opportunity to apply dispersants as predicted by the oil spill modelling (refer to Section 6.4) and limited predicted effectiveness on HFO hydrocarbon products.

Table 13-6 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 13-7 lists resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial aerial dispersant operations are listed in Table 13-8. The Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 13-6: Implementation guidance – aerial dispersant application

Action		Consideration	Responsibility	Complete
Initial Actions	Confirm operational NEBA supports surface chemical dispersant application	Oil type suits dispersant application Surveillance to confirm oil spill thickness (e.g. BAOAC 4 to 5) supports use of dispersants Liaise with third-party providers (e.g. AMOSC) as part of operational NEBA. Evaluate oil spill trajectory modelling when available Guidance is provided as per AMSA guideline: Obtaining Approval to Use an Oil Spill Control Agent at Sea or on a Shoreline (AMSA, 2022)	Planning Section Chief Environment Unit Leader	☐
	For dispersant use in State waters – seek approval from WA DoT If dispersant use in Commonwealth waters could impact State waters, notify WA DoT	The WA DoT SMPC requests early notification if use of dispersant in Commonwealth waters could impact WA State waters. The NT Control Agency should also be notified if there is a risk of impact to NT waters (refer to Section 4.6.4).	Planning Section Chief	☐
	Activate Joint Industry OMP: Surface Chemical Dispersant Fate and Effectiveness Assessment via the OSM Services Provider (refer to Northern Australia OSM-BIP [7715-650-ERP-0003], Section 12)	Initiation criteria for OMP: Surface Chemical Dispersant Fate and Effectiveness Assessment is: • application of dispersant has been selected as a response option. Therefore, this OMP requires immediate activation via the Northern Australia OSM-BIP (7715-650-ERP-0003, Section 12). Note: The shake test assessment does not form part of OMP: Surface Chemical Dispersant Fate and Effectiveness Assessment and is usually performed as an initial assessment of dispersant efficacy.	Planning Section Chief Environment Unit Leader	☐
	Mobilise initial resources for aerial application After initial AMOSC notifications are complete, contact AMOSC Duty Officer and confirm requirements for these resources: • Access to and mobilisation of required AMOSC dispersant stocks and associated equipment into designated airstrip (AMOSC will arrange through their contracted transport provider) • Activation of the fixed-wing aerial dispersant capability (FWADC) (AMOSC will activate this on behalf of Santos) • Provision of trained spill responders to support operations (AMOSC staff and Core Group)	Refer Joint Standard Operating Procedures for FWADC AMOSC will deploy appropriate aircraft to a designated airstrip close to the spill location (e.g. Darwin Airport), and arrange for pilots, air attack supervisors, observation aircraft (one per 2 attack aircraft) and trained observers	Logistics Section Chief Operations Section Chief Aviation Superintendent	☐
	Finalise Fixed-wing Air Operations Plan and Air Operations Plan in consultation with AMOSC, AMSA, Aerotech First Response and other stakeholders	Ensure flight schedule in Air Operations Plan considers requirements for other activities such as aerial surveillance sorties	Operations Section Chief Aviation Superintendent Planning Section Chief	☐

Action		Consideration	Responsibility	Complete
	Using real-time or most recent visual surveillance observation data, develop operational zones for aerial dispersant operations	Focus on applying dispersant to areas of slick that threaten priority receptors and are of a sufficient thickness whereby chemical dispersants will be effective. The base case restrictions for dispersant application are – no application within: • a Habitat Protection Zone or National Park Zone of an AMP (application considered in the Multiple Use Zone) • Territory/State Marine Parks • Territory/State waters • 10 km of water depths <10 m LAT • exclusion zones of offshore facilities. The above applies unless justified otherwise by the operational NEBA. Note: No application is allowed in AMPs (outside Multi-use zone) or Territory/State waters without relevant authority approval (refer to Section 4.6.4 for the process on obtaining consent for dispersant use and on notification to the relevant Control Agency of use in adjacent Commonwealth waters).	Operations Section Chief Planning Section Chief	☐
	Ensure shake jar test is conducted in-field to determine likely effectiveness of dispersant application and report results to IMT	Refer to NP-GUI-013: National Plan oil spill dispersant effectiveness field test kit operational guide for guidance on how to conduct a dispersant field test	Operations Section Chief	☐
	Depending on the results of the shake jar test, aircraft are deployed to conduct a test spray Monitor for efficacy using the SMART Protocol (Section 13.6) as described in OMP: Surface Chemical Dispersant Fate and Effectiveness Assessment and provide results to the IMT	Initial monitoring is likely to only include Tier I (visual monitoring) of the SMART Protocol. Observers trained in visual observation techniques should be used	Operations Section Chief	☐
	Conduct aerial dispersant spraying, reporting effectiveness to IMT.	-	Operations Section Chief Planning Section Chief	☐
Ongoing Actions	Conduct operational NEBA during each operational period to re-assess effectiveness of application rates and dispersant efficacy	-	Environment Unit Leader Planning Section Chief	☐
	Maintain operational zones and provide updates to pilots on most suitable locations for aerial application	-	Operations Section Chief Planning Section Chief	☐

Table 13-7: Aerial chemical dispersants application – resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Aerotech First Response fixed-wing aircraft, pilots and ground crew	AMOSC – Fixed-wing Aerial Dispersant Contract	4 under FWADC contract Additional aircraft potentially available through Aerotech First Response	Operations from designated airbase Aircraft initially mobilised from 4 bases around Australia: • Jandakot (WA) • Batchelor (NT) • Parafield (SA) • Scone (NSW)	4 air contractors to have wheels up in 4 hours from locations around Australia. Mobilisation times depend on the flight time from the location of the aircraft Supporting equipment mobilisation (dispersants etc.) as per equipment mobilisation timeframes (Table 10-12)
Hercules C-130 aircraft	OSRL	One plane	Senai, Malaysia	Wheels up in 6 hours Flight time from Senai (WADD) to Darwin (YDPN) is 8 hours (including one technical stop at Bali/Makassar)
Air attack / aerial observation aircraft	Santos-contracted helicopter provider/s + contracted fixed-wing providers	Two (contracted) + additional subject to availability	Darwin, Karratha	Wheels up within 1 hour for ER
Dispersant	AMOSC	Refer to Table 13-9		Response via duty officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call; for equipment mobilisation timeframes refer to Table 10-12
	AMSA	Refer to Table 13-9		Access to National Plan equipment[38] through AMOSC[39]. Equipment mobilisation times vary according to stockpile location.
FWADC operational personnel include Air Attack Supervisor and Dispersant Operations Coordinator	AMOSC and subcontractors via Fixed-wing Aerial Dispersant Contract	AMOSC staff + contractors, as per AMOSC FWADOps Plan (AMOSC, 2022)	AMOSC Fremantle AMOSC Geelong	Response via duty officer within 15 minutes of first call; timeframe for availability of AMOSC personnel depends on location of spill and transport to site
Search and Rescue (SAR) vessel (can be double-use vessel)	Santos-contracted vessel providers	Varies – check through vessel contractors/ Santos vessel tracking system	Darwin	Varies subject to location / availability

[38] Updated AMSA equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal: https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations

[39] Santos will enter a contractual arrangement with AMSA to access the National Plan resources

Table 13-8: Aerial dispersant operations – first-strike response timeline

Task	Time from IMT call-out
IMT confirms applicability of strategy and activates FWADC	<3 hours
AMOSC to mobilise fixed-wing aircraft to nominated airbase	<12 hours
AMOSC to mobilise dispersants to nominated airbase	<24 hours
AMOSC to mobilise all FWADC capability personnel to nominated airbase	<48 hours
AMOSC/Santos to mobilise air attack / aerial observation aircraft to nominated airbase to support air-attack surveillance	<48 hours
AMOSC/Santos to mobilise vessel to nominated port to provide SAR support	<48 hours
First FWADC test spray	<48 hours (weather/daylight dependent)
Minimum resource requirements	
• 1 fixed-wing aircraft (Aerotech First Response) • 1 air attack / aerial observation aircraft • 1 SAR Vessel • AMOSC dispersant stocks to deployment airbase (refer to Table 13-9) • AMOSC contracted FWADC capability personnel: – Pilots – Air Attack Supervisor – Aerial Observer – FOB Commander – Airbase Manager – Safety Officer – Dispersant Operations Coordinator – Dispersant Loading Crew – Log/ Admin.	

13.5 Dispersant selection process

13.5.1 Dispersant use

Dispersants should only be used when the risks to the environment as a whole associated with their use have been analysed, and it has been determined that there would be a net environmental benefit from their use. The type of dispersant that will be effective is influenced by the oil type and metocean conditions (Hook and Lee, 2015).

Most of the knowledge on the biological impacts of dispersants has been developed via laboratory experiments (Quigg et al., 2021) rather than from in situ use. This is also the case for those dispersants listed as approved in the National Plan for Maritime Environmental Emergencies Register of Oil Spill Control Agents (OSCA). Before a dispersant can be considered for use by AMSA, its toxicological impact must be tested on a diverse range of aquatic taxa, including algae, invertebrates and fish (Hook and Lee, 2015). This screening process ensures that these compounds have comparatively low toxicity (according to US Environmental Protection Agency criteria; Hemmer et al., 2011) and that they are much less toxic than oil (Hook and Lee, 2015).

Although surface dispersants have been used as an oil spill response technique for multiple spills across the globe since the 1970s, there is a lack of information about the long-term consequences of dispersant use in the marine environment (Quigg et al., 2021). However, the available research has found no compelling evidence that at low to moderate oil concentrations that chemically dispersed oil was any more toxic than oil alone (NASEM, 2020). However, at high concentrations the combination of oil and dispersant appeared more toxic (Quigg et al., 2021), suggesting caution should be applied when considering dispersant application rates and volumes. This also shows the importance of ongoing dispersant effectiveness monitoring (Section 13.6) and its application through the operational NEBA process.

13.5.2 Dispersant selection

Chemical dispersants listed as approved in the National Plan for Maritime Environmental Emergencies Register of Oil Spill Control Agents (OSCA) are to be prioritised for use. OSCA-listed dispersants are readily available to Santos through AMOSC, OSRL and AMSA, and include Slickgone NS, Slickgone EW, Corexit EC9500A, Corexit 9527 (transitional acceptance) and Finasol OSR 52. As described in Section 13.7, there are sufficient stockpiles of these dispersants in Australia to service the entire duration of surface application. Safety data sheets for these products are available at the AMSA register of oil spill control agents, and for Corexit 9527 (which has transitional acceptance), at the manufacturer's website.

If dispersant types additional to those on the OSCA register are required, Santos will use its Offshore Division Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) before application. The procedure requires a dispersant to be risk assessed and deemed environmentally acceptable. The criteria used for environmental acceptability includes aquatic toxicity, biodegradation and bioaccumulation potential data. Finasol OSR 52 has been pre-assessed as low risk using this procedure and therefore is designated as acceptable for use.

If sufficient data are available, the chemical is risk assessed using the Offshore Chemical Notification Scheme (OCNS) CHARM or non-CHARM models depending on the model's applicability criteria. Chemicals that meet the selection criteria belonging to CHARM colour-band Gold or Silver, or non-CHARM groups D or E are considered environmentally acceptable. According to the OCNS CHARM model, Gold-ranked chemicals have a maximum Hazard Quotient (HQ) of <1, and Silver, HQ ≥1 and <30. According to the OCNS non-CHARM model guidelines, the worst-case initial OCNS grouping would be group B based on aquatic toxicity data of LC_{50} or EC_{50} >1 to 10 ppm. To obtain a final OCNS grouping of D, the chemical would need to be readily biodegradable (>60% biodegradation in 28 days) and non-bioaccumulative (Log Pow <3 or Bioconcentration Factor (BCF) ≤100 and molecular weight ≥700). The best case initial OCNS grouping would be group E based on aquatic toxicity data of LC_{50}/EC_{50} >1,000 ppm. The best case final OCNS grouping would remain E with the chemical readily biodegradable and non-bioaccumulative.

If the chemical cannot be rated using the method described above, it would be assigned a pseudo OCNS CHARM or non-CHARM group ranking. If insufficient ecotoxicity data are available to either rate the chemical or assign a pseudo ranking, robust justification demonstrating its environmental acceptability shall be provided, based on volume/concentration, receiving marine environment characteristics and ecotoxicity data (aquatic toxicity, biodegradability and/or bioaccumulation data where applicable; i.e. biodegradation and bioaccumulation potential are not applicable to inorganic substances).

During a response, chemical dispersant shall be tested on the released oil at a laboratory as part of the initial oil characterisation (refer to Section 10.6) as well as through field testing using dispersant shake test kits. The Territory/State ESC can also advise on the location of AMSA National Plan Dispersant Effectiveness Test Kits, which could be used in addition to Santos' dispersant efficacy testing resources.

13.6 Dispersant effectiveness monitoring

Santos will conduct dispersant effectiveness monitoring for surface application in accordance with the Northern Australia OSM-BIP (7715-650-ERP-0003), Joint Industry OSM Framework (APPEA, 2021) and OMP: Surface chemical dispersant fate and effectiveness assessment (APPEA, 2021) (Section 18). This assessment is conducted after the initial shake test and is based on the SMART protocol (NOAA, 2006).

13.7 Surface dispersant supply and logistics requirements

Dispersant stockpiles are made available via AMOSC membership or AMSA agreement with most supplies within Australia being available within 48–55 hours. Santos can supply all required road logistics to meet these timeframes through its contracted logistics provider. Santos can also provide air logistics for all other stockpiles throughout Australia and internationally.

Dispersant availability is checked twice a year against Santos' worst-case requirements across all operational, project and drilling activities.

Table 13-9: Dispersant supply stock locations and volumes

Source	Stock location	Volume (m^3)	Type	Total volume (m^3)
AMSA	Adelaide	10	Slick Gone EW	355
		10	Slick Gone NS	
	Brisbane	10	Slick Gone EW	
		10	Slick Gone NS	
	Townsville (Queensland)	10	Slick Gone EW	
		15	Slick Gone NS	
	Karratha	10	Slick Gone EW	
		10	Slick Gone NS	
	Darwin	10	Slick Gone EW	
		10	Slick Gone NS	
	Devonport (Tasmania)	10	Slick Gone EW	
		10	Slick Gone NS	
	Fremantle	48	Slick Gone NS	
		52	Slick Gone EW	
	Horn Island (Queensland)	10	Slick Gone NS	
	Melbourne	10	Slick Gone EW	
		10	Slick Gone NS	
	Sydney	45	Slick Gone NS	
		55	Slick Gone EW	
AMOSC	Exmouth	75	Slick Gone NS	511 (surface)
	Welshpool	8	Slick Gone NS	
		27	Corexit 9500	
		250 (= 50% of Subsea First Response Toolkit stockpile*)	Slick Gone NS	
	Altona North (Victoria)	75	Slick Gone NS	
		62	Corexit 9500	
	Broome	14	ARDROX 6120	

Source	Stock location	Volume (m³)	Type	Total volume (m³)
OSRL (Santos has access up to 50% of SLA stockpile)	Various (Singapore, UK, Bahrain, US)	50% of SLA = 207†	Slick Gone NS Slick Gone EW Slickgone LTSW Finasol OSR 52 Corexit 9500	207
Total				**1,073**
OSRL GDS	Various (Singapore, France, South Africa, US, Brazil)	5,000†	Slick Gone NS Finasol OSR 52 Corexit 9500	5,000
Total (including additional OSRL GDS stocks)				**6,073**

** As per the AMOSPlan, there is a provision made by the Subsea First Response Toolkit Steering Committee to provide up to 250 m³ of dispersant into a surface spill response, given certain provisions are met in the first instance by AMOSC (AMOSC, 2021).*

† Latest numbers as of April 2024. The SLA Equipment Stockpile Status Report and the Global Dispersant Stockpile Status Report (available from the Response Readiness Dashboard) provides the current status of the SLA dispersant stocks.

13.8 Environmental performance

Table 13-10 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 13-10: Environmental performance – surface dispersant application

Environmental performance outcome	Implement chemical dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities.		
Response strategy	**Control measures**	**Performance standard [EPS ID]**	**Measurement criteria**
Chemical dispersant application – surface	**Response preparedness**		
	Arrangements to enable access to dispersants, equipment and personnel	[EPS-CD-001] Maintenance of access to dispersant, application equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity as specified in Table 13-4 and Table 13-7	Access to National Plan resources through AMSA AMOSC Participating Member contract OSRL Associate Member contract and GDS Supplementary Agreement TRG arrangements
	Maintenance of MSAs with multiple vessel providers	[EPS-CD-010] Santos maintains MSAs with multiple vessel providers that could be used to source vessels for dispersant application	MSAs with multiple vessel providers
	Dispersant application vessel requirements are identified	[EPS-CD-009] Maintenance of vessel specification for dispersant application vessels	Vessel specification within Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Response implementation		
	Mobilisation of minimum resource requirements for initial response operations	[EPS-CD-013] First-strike is mobilised in accordance with details and timings as specified in first-strike response timeline tables (Vessel-based dispersant application – Table 13-5, Aerial dispersant operations – Table 13-8)	Incident log
	Process in place for dispersant selection	[EPS-CD-002] Only chemical dispersants that are listed as approved on the National Plan Oil Spill Control Agent (OSCA) list, or are evaluated as acceptable as per the Operations Chemical Selection, Evaluation and	National Plan Oil Spill Control Agent (OSCA) list Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001)

Environmental performance outcome	Implement chemical dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities.		
Response strategy	**Control measures**	**Performance standard [EPS ID]**	**Measurement criteria**
		Approval Procedure (EA-91-II-10001), are to be used	Chemical Dispersant Application Plan Incident Log
	Chemical Dispersant Application Plan	[EPS-CD-015] Santos will have access to dispersants specified in Table 13-9	Incident Log
	Operational monitoring of surface dispersant efficacy will be conducted	[EPS-CD-020] Santos will conduct surface dispersant efficacy monitoring in accordance with the Northern Australia OSM-BIP (7715-650-ERP-0003) and OM4: Dispersant Effectiveness and Fate Assessment (APPEA, 2021)	Incident Log Chemical Dispersant Application Plan
	Field testing of dispersant amenability	[EPS-CD-021] Analysis of dispersant amenability provided to IMT within 24 hours of oil delivery to laboratory	Incident Log Dispersant Amenability Report
	Field testing of dispersant / oil samples for ecotoxicity	[EPS-CD-022] If amenable to surface dispersants, and required oil volume can be collected, oil and dispersant samples to be sent for laboratory ecotoxicity testing of oil and chemically dispersed oil	Incident Log Dispersant Ecotoxicity Report
	Test spray for assessment of dispersant effectiveness – aerial	[EPS-CD-024] If dispersant application is approved by the Incident Commander for aerial application, a test spray run via the National Plan Fixed-wing Aerial Dispersant Contract will be conducted to assess dispersant effectiveness	Incident Log IAP
	Test spray for assessment of dispersant effectiveness – vessel	[EPS-CD-011] If dispersant application is approved by the Incident Commander for vessel application, a test spray will be conducted to assess dispersant effectiveness	Incident Log IAP
	Prepare operational NEBA to determine if chemical dispersant application activities are likely to result in a net environmental benefit	[EPS-CD-016] Records indicate operational NEBA completed prior to chemical dispersant activities commencing. Operational NEBA to be undertaken each operational period and included in development of following period IAP. NEBA will consider the following information • forecast spill modelling of oil comparing simulations with and without effect of chemical dispersants • laboratory dispersant efficacy testing results • operational monitoring results (surveillance and shoreline assessment) showing distribution of floating, stranded oil and location of sensitive fauna and habitats • operational water quality monitoring results showing distribution and concentration of subsea oil (once available)	Incident Log IAP

Environmental performance outcome	Implement chemical dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities.		
Response strategy	**Control measures**	**Performance standard [EPS ID]**	**Measurement criteria**
		• scientific monitoring water quality sampling results (once available) • consultation with Control Agency and/or key stakeholders	
	Dispersant application area to be defined to minimise impacts to sensitive areas	[EPS-CD-018] Surface Dispersant Application Area will be defined as part of the IAP. The base case for dispersant application is that no dispersants to be applied within: • 10 km of water depths <10 m LAT • safety exclusion zones of offshore facilities • a Habitat Protection Zone or National Park Zone of an AMP (application considered in the Multiple Use Zone) • Territory/State Marine Parks • Territory/State waters	IAP
	Dispersant application to target thick oil to maximise efficacy and minimise over application	[EPS-CD-019] Surface dispersant will only be applied in the dispersant application area and target oil above BAOAC 4 and 5	Operational monitoring reports IAP Incident Log

14. Shoreline protection and deflection plan

Table 14-1 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 14-1: Shoreline protection and deflection – objectives, initiation and termination criteria

Environmental performance outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities		
Initiation criteria	• Level 2 or Level 3 spills where shorelines with identified or potential protection priorities will potentially be contacted • Approval has been obtained from the relevant Control Agency to initiate the response strategy		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓ 2	✓	✓ 2
Termination criteria	• NEBA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s • Agreement is reached with Jurisdictional Authorities and/or Control Agency to terminate the response strategy		

14.1 Overview

Protection and deflection tactics are used to divert hydrocarbons away from sensitive shoreline receptors and are more effective if they are deployed ahead of spill contact. They are typically used to protect smaller, high priority sections of shoreline.

The effectiveness of this response will depend on spill characteristics, hydrocarbon type, and the operating environment. Deployment is subject to safety constraints such as the potential grounding of vessels.

Protection and deflection is part of an integrated nearshore/shoreline response to be managed by the relevant Control Agency. If Santos is not the Control Agency (refer to Table 4-2), it will undertake first-strike protection and deflection activities as required. In this circumstance, the relevant Control Agency will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline protection. Santos will provide all relevant information on shoreline character and oiling collected as part of surveillance activities (SCAT surveys) carried out under its control (refer Northern Australia OSM-BIP [7715-650-ERP-0003]).

DCCEEW are the designated Jurisdictional Authority for all spills that contact the shorelines of Ashmore Reef and Cartier Island AMPs identified in this OPEP; the Santos IMT (as Control Agency for these islands as they are in Commonwealth waters) will liaise with DCCEEW to direct resources for the purposes of shoreline clean-up activities.

In the event of a spill with the potential for shoreline contact where Santos is not the Control Agency, the ongoing response objectives, methodology, deployment locations and resource allocation will be controlled by the relevant Control Agency and therefore may differ from that included below.

Information gathered during monitor and evaluate activities and operational monitoring (including shoreline clean-up assessments) and assessed through an operational NEBA will guide the selection of protection and deflection locations and techniques.

Shoreline protection and deflection techniques include:

- nearshore booming, which can involve different booming arrangements, including:
  - exclusion booming: boom acts as a barrier to exclude the spill from areas requiring protection
  - diversion booming: booms divert the spill to a specific location where it may be removed (e.g. sandy beach)
  - deflection booming: booms deflect the spill away from an area requiring protection.
- berms, dams and dykes – uses sandbags or embankments to exclude oil from sensitive areas
- shoreside recovery – uses nearshore skimmers to collect oil corralled by nearshore booms (also used during shoreline clean-up)
- passive recovery – uses sorbent booms or pads to collect oil and remove it from the environment. This can be used as a pre-impact tactic where sorbents are laid ahead of the spill making contact with the shoreline
- non-oiled debris removal – removes debris from the shoreline before it is impacted to reduce overall waste volumes from shoreline clean-up.

The effectiveness of these techniques will depend on local bathymetry, sea state, currents/tides and wind conditions and the available resources.

14.2 Implementation guidance

Table 14-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 14-3 lists resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial protection and deflection operations, unless directed otherwise by the relevant Control Agency, are listed in Table 14-4. The Incident Commander of the Control Agency's IMT (once they assume control) is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 14-2: Implementation guidance – shoreline protection and deflection

Action		Consideration	Responsibility	Complete
Initial Actions	Ensure initial notifications to the relevant Control Agency have been made.	Refer to Section 7 for reporting requirements.	Planning Section Chief	☐
	Collect and provide monitor and evaluate information, operational monitoring data and existing sensitivity information/mapping to Control Agency for confirming priority protection areas and NEBA.		Environment Unit Leader Planning Section Chief	☐
	Actions below are indicative only and are at the final determination of the relevant Control Agency.			
	Conduct operational NEBA to determine if protection and deflection is likely to result in a net environmental benefit using information from shoreline clean-up assessments (refer Northern Australia OSM-BIP [7715-650-ERP-0003]).	TRPs to be developed for the Priority Protection Areas for this activity, further described in Section 6.6.1. TRPs are available on the Santos ER SharePoint page[40].	Environment Unit Leader	☐
	If NEBA indicates that there is an overall environmental benefit, develop a Shoreline Protection Plan (IAP Sub-Plan) for each deployment area.	Shoreline Protection Plan may include: • priority nearshore and shoreline areas for protection (liaise with Control Agency for direction on locations) • locations to deploy protection and deflection equipment • permits required (if applicable) • protection and deflection tactics to be employed for each location • list of resources (personnel and equipment) required • logistical arrangements (e.g. staging areas, accommodation, transport of personnel) • timeframes to undertake deployment • access locations from land or sea • frequency of equipment inspections and maintenance (noting tidal cycles) • waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes • no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (use existing roads and tracks first) • shift rotation requirements	Operations Section Chief Planning Section Chief Environment Unit Leader	☐

[40] *Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, NTOWRP and WAMOPRA.*

Action		Consideration	Responsibility	Complete
	If required identify vessels with relevant capabilities (e.g. shallow draft) for equipment deployment in consultation with Control Agency.	Ensure vessels have shallow draft and/or a suitable tender (with adequate towing capacity and tie-points) if they are required to access shorelines.	Operations Section Chief Logistics Section Chief	☐
	Deploy shoreline protection response teams to each shoreline location selected and implement response.	If passive recovery and/or non-oiled debris removal has been selected as a tactic, ensure deployment activities prioritise their implementation before hydrocarbon contact.	Operations Section Chief On-Scene Commander	☐
Ongoing Actions	Conduct daily re-evaluation of NEBA to assess varying net benefits and impacts of continuing to conduct shoreline protection and deflection activities.	-	Environment Unit Leader	☐
	Report to the Operations Section Chief on the effectiveness of the tactics employed.	-	Shoreline Response Program Manager – AMOSC Core Group responder	☐
	Response teams to conduct daily inspections and maintenance of equipment.	Shoreline protection efforts will be maintained through the forward operation(s) facilities set-up at mainland locations under direction of the Control Agency. Response crews will be rotated on a roster basis, with new personnel procured on an as needs basis from existing human resource suppliers.	Shoreline Response Program Manager	☐

Table 14-3: Shoreline protection and deflection – resource capability

Equipment type/ personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
AMSA nearshore boom/skimmer equipment	AMSA	Canadyne inflatable Total – 10	Darwin – 5 Karratha – 5	Access to National Plan[41] equipment through AMOSC[42] Equipment mobilisation times vary according to stockpile location.
		Structureflex inflatable Total – 34	Darwin – 9 Karratha – 10 Fremantle – 15	
		Versatech zoom inflatable Total – 28	Darwin – 10 Karratha – 5 Fremantle – 13	

[41] *Updated AMSA Equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal - https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[42] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources*

Equipment type/ personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
		Slickbar – solid buoyancy Total – 2	Karratha – 2	
		Structureflex – solid buoyancy Total – 13	Karratha – 3 Fremantle – 10	
		Structureflex – land sea Total – 69	Darwin – 9 Karratha – 30 Fremantle – 30 other locations around Australia	
		LWS 500 weir skimmer Total – 8	Fremantle – 4 Karratha – 4	
		Desmi termite skimmer Total – 3	Fremantle – 1 Karratha – 1 Darwin – 1	
		Lamor 15 ton disc skimmer Total – 6	Darwin – 2 Karratha – 4	
		Lamor 50 ton weir skimmer Total – 3	Darwin – 1 Karratha – 2	
AMOSC nearshore boom and skimming equipment	AMOSC	Beach Guardian shoreseal boom (25 m lengths) Total – 89	Broome – 4 Exmouth – 20 Fremantle – 19 Geelong – 46	Response via duty officer within 15 minutes of first call; AMOSC personnel available within one hour of initial activation call. Equipment logistics varies according to stockpile location[43] For mobilisation timeframes refer to Table 10-12
		Zoom Boom (25 m lengths) Total – 185	Broome – 6 Exmouth – 19 Fremantle – 34 Geelong – 126	
		Lamor HDB 1300 Boom (200 m) on reel Total – 2	Broome – 2	
		Lamor HDB 1500 Boom (100 m on reel) Total – 3	Fremantle – 1 Geelong – 2	

[43] *Updated AMOSC equipment listings are available through AMOSC Members Hub - https://amosc.sharepoint.com/sites/HUB/SitePages/CollabHome.aspx*

Equipment type/ personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
		Lamor SFB-18 GP Solid Flotation Curtain Boom (30 m lengths) Total – 58	Fremantle – 18 Geelong – 40	
		Minimax 12 brush skimmer Total – 5	Broome – 1 Exmouth – 1 Fremantle – 2 Geelong – 1	
		Komara 12k disc skimmer Total – 4	Exmouth – 1 Fremantle – 1 Geelong – 2	
		Komara 20k disc skimmer Total – 1	Fremantle – 1	
		Komara 30k disc skimmer Total – 2	Geelong – 2	
		Passive weir skimmer Total – 3	Exmouth – 1 Fremantle – 1 Geelong – 1	
		Ro-vac vacuum skimmer Total – 4	Exmouth – 1 Geelong – 3	
		Desmi GT 185 brush/weir skimmer Total – 2	Exmouth – 1 Geelong – 1	
		Desmi Ro-mop 240 oil mop skimmer Total – 2	Exmouth – 1 Geelong – 1	
		Desmi Ro-mop 260 oil mop skimmer Total – 2	Fremantle – 1 Geelong – 1	
		Skimmer-Lamor Rock Cleaner-Brush Total – 4	Fremantle – 2 Geelong – 2	
		Skimmer-Lamor LWS500-brush/weir skimmer Total – 6	Fremantle – 3 Geelong – 3	
		Desmi 250 weir skimmer Total – 1	Geelong – 1	

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Equipment type/ personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
		Canadyne multi head-brush/disc/drum Total – 1	Geelong – 1	
		Versatech multi head-brush/disc/drum Total – 1	Geelong – 1	
		Egmopol barge with brush skimmer Total – 1	Geelong – 1	
Industry Mutual Aid nearshore boom and skimming equipment	Facilitated by AMOSC	Nearshore boom and skimmers	WA/NT	Access to Industry Mutual Aid through AMOSPlan and facilitated by AMOSC
OSRL nearshore boom/skimming equipment (Note: further booms are available; the listed items are shown as an example). Guaranteed access to 50% of stockpile by equipment type. Access to more than 50% on a case-by-case basis.	OSRL	Air-skirt boom 10 m: 228 Air-skirt boom 20 m: 658 Air-skirt boom 200 m: 4 Beach sealing boom 10 m: 154 Beach sealing boom 15 m: 65 Beach sealing boom 20 m: 113 Inshore recovery skimmers: 126 Range of ancillaries to support above equipment	OSRL global stockpiles at base locations: • UK • Singapore • Bahrain • Fort Lauderdale (US)	Response from OSRL Duty Manager within 10 minutes. Equipment logistics varies according to stockpile location.
Personnel (field responders) for OSR strategies	AMOSC staff	Total – 12	Fremantle – 5 Geelong – 7	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel depends on location of spill and transport to site
	AMOSC Core Group (Santos)	Total – 16	Perth/NW Australia facilities – 14 Port Bonython (South Australia) – 2	From 24 hours <48 hours to NT locations
	Santos IMO1 personnel (Darwin)	6	Darwin	<24 hours to deployment port location
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility location across Australia	Location dependent. Confirmed at time of activation

Table 14-4: Shoreline protection and deflection – first-strike response timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirm if protection of shoreline sensitivity/s is required and begins sourcing resources	<4 hours
Santos Core Group mobilised to deployment port location	<24 hours
Protection booming equipment mobilised to deployment port location	<24 hours
Waste storage equipment mobilised to deployment port location	<24 hours
Boom deployment vessel mobilised to deployment port location	<24 hours
AMOSC staff and Industry Core Group mobilised to deployment port location	<48 hours
Protection/deflection operation deployed to protection location	<60–72 hours (weather/daylight dependent)
Minimum resource requirements	
Note: Resource requirements for protection and deflection will be situation/receptor specific. TRPs are held by Santos and WA DoT and have been developed for various locations and are available on the Santos ER SharePoint page; A TRP will be developed for the Tiwi Islands, which is a Priority Protection Area for this activity, as further described in Section 6.6.1 [44]. Indicative first-strike resources for a single site protection area are: • 1 small vessel suitable for boom deployment • Shoreline (e.g. Beach Guardian) and nearshore booms (e.g. Zoom Boom) plus ancillary equipment (e.g. anchors, stakes) sufficient for protecting shoreline resources • 1 skimmer appropriate for oil type • Waste storage equipment • 1 Protection and Deflection Team • PPE	

14.3 Worst-case resourcing requirements

Protection and deflection resourcing requirements have been determined from deterministic modelling for affected shorelines. Deterministic run #68 (surface release of MDO from a vessel [500 m^3 released over 1 hour]) was selected to guide resourcing estimates for protection and deflection given it was the simulation that represented the shortest time to the arrival of accumulated shoreline loading ≥100 g/m^2 and was the simulation with the greatest length of Australian shoreline receptors contacted ≥100 g/m^2. These worst-case personnel resourcing numbers for shoreline protection and deflection are provided as part of the cumulative resourcing assessment in Appendix Q.

This deterministic run does not include all possible spill scenarios; a single spill may contact other receptors and at different volumes, as presented in Section 6.3. However, the selection of this run will provide the worst-case shoreline loading scenario on which to base protection and deflection response preparedness arrangements.

Resource requirements for protection and deflection will be situation-/receptor-specific. A TRP will be developed by Santos for PPAs before the activity commences (refer to Section 6.6.1).

Table 14-5: Shoreline protection and deflection resource requirements (based on deterministic simulation #68 for surface release of MDO from a vessel [500 m^3 released over 1 hour]); RPS, 2023)

Location	Minimum arrival time shoreline oil accumulation ≥100 g/m^2 (days:hours)	Maximum length of shoreline oiled (km) ≥100 g/m^2	Estimated No. of required protection and deflection teams to set up and monitor (and remarks)
Tiwi Islands	4 days: 3 hours	5	1–2 teams (small length of shoreline predicted to be impacted; 1–2 teams considered sufficient to protect shoreline receptors)
Total estimated Protection and Deflection Teams required			**1–2 teams**

[44] *Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, NTOWRP and WAMOPRA*

Capability allows for mobilisation of protection and deflection resources (refer to Table 14-3) by day 2-3 if required (Table 14-4). However, the shortest timeframe to shoreline accumulation ≥100 g/m^2 is not predicted until day 4 at Tiwi Islands. This allows sufficient time to organise, mobilise and deploy protection and deflection personnel and equipment prior to hydrocarbon contact, guided by ongoing monitoring and evaluation, and operational monitoring.

A typical shoreline protection and deflection team would comprise 12 personnel as a minimum:

- 1 Incident Commander/Site Supervisor
- 1 Shallow draft vessel skipper
- 1 Shallow draft vessel deck-hand
- 9 Protection and deflection operatives.

The resourcing requirements will be determined based on feedback from SCAT activities, on operational NEBA, and in consultation with the NT Control Agency, or WA DoT as the Control Agency if in WA State waters. Shoreline effort will likely comprise a combination of protection and deflection and clean-up, with resources often working together and/or in parallel.

14.4 Environmental performance

Table 14-6 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 14-6: Environmental performance – shoreline protection and deflection

Environmental performance outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
Shoreline Protection and Deflection	**Response preparedness**		
	Access to protection and deflection equipment and personnel	[EPS-PD-002] Maintenance of access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan, OSRL and TRG throughout activity as per Table 14-3.	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
			TRG arrangements
	Protection and deflection small vessel providers for nearshore booming operations are identified	[EPS-PD-004] Maintenance of a list of small vessel providers operating in the Darwin region that could be used for nearshore booming	List of small vessel providers
	Response implementation		
	First strike capability mobilised	[EPS-PD-005] First strike is mobilised in accordance with details and timings as specified in Table 14-4 unless directed otherwise by Control Agency	Incident log
	IMT and Control Agency to agree protection priorities	[EPS-PD-007] Santos IMT to confirm protection priorities in consultation with Control Agency	IAP Incident Log
	Prepare operational NEBA to determine if shoreline protection and deflection activities are likely to result in a net environmental benefit	[EPS-PD-008] Records indicate operational NEBA completed prior to shoreline protection and deflection activities commencing. Operational NEBA to be undertaken each operational period. Ensure NEBA considers waste management and the possibility of secondary contamination.	Operational NEBA Incident Log IAP
	IAP Protection and Deflection Sub-plan is developed to ensure effective execution and	[EPS-PD-006] IAP Shoreline Protection and Deflection Sub-plan including shoreline/nearshore habitat/bathymetry assessment and	Incident Log IAP Shoreline Protection and Deflection Sub-plan

Environmental performance outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
	environmental impacts from response are minimised	waste management is developed to provide oversight and management of shoreline protection and deflection operation, prior to shoreline protection and deflection operations commencing	
	Use of shallow draft vessels for shoreline and nearshore operations	[EPS-PD-009] Shallow draft vessels are used for shoreline and nearshore operations, unless directed otherwise by the designated Control Agency	Vessel specifications documented in IAP.
	Conduct rapid shoreline/nearshore habitat/bathymetry assessment	[EPS-PD-010] Unless directed otherwise by the designated Control Agency, a rapid shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities	IAP records; Assessment records

15. Shoreline clean-up plan

Table 15-1: Shoreline clean-up – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery		
Initiation criteria	• Level 2 or Level 3 spills where shorelines with identified or potential protection priorities that will be, or have been, contacted • NEBA indicates shoreline clean-up will benefit receptors • Approval has been obtained from the Control Agency (where applicable) to initiate response strategy		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓ 2	✓	✓ 2
Termination criteria	• NEBA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s • Agreement is reached with Jurisdictional Authorities and/or Control Agency to terminate the response strategy		

15.1 Overview

Shoreline clean-up aims to remove hydrocarbons from shorelines and intertidal habitat to achieve a net environmental benefit. Removing these hydrocarbons helps reduce hydrocarbon remobilisation and contamination of wildlife, habitat and other sensitive receptors. Shoreline clean-up is often a lengthy and cyclical process, requiring regular shoreline clean-up assessments (refer Northern Australia OSM-BIP [7715-650-ERP-0003]) to monitor the effectiveness of clean-up activities and assess if they are resulting in any adverse impacts.

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be managed by the relevant Control Agency. Where Santos is not the Control Agency (refer to Table 4-2), it will undertake first-strike activations as required. In this circumstance, the relevant Control Agency will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline clean-up. The information obtained from monitoring and evaluation tactics (refer to Section 10) and operational monitoring (Section 18), will be used by the IMT in developing the operational NEBA to inform the most effective clean-up tactics (if any) to apply to individual sites. Intrusive shoreline clean-up techniques have the potential to damage sensitive shorelines. The appropriateness of clean-up tactics will be assessed against natural attenuation for sensitive sites. Selection of shoreline clean-up methods and controls to prevent further damage from the clean-up activities are to be undertaken in consultation with the Control Agency and selected based on NEBA.

DCCEEW are the designated Jurisdictional Authority for all spills that contact the shorelines of Ashmore Reef AMP and Cartier Island AMP identified in this OPEP; the Santos IMT (as Control Agency for this island as it is in Commonwealth waters) will liaise with DCCEEW to direct resources for the purposes of shoreline clean-up activities.

Spill modelling indicates that the HFO spill scenario (surface release of HFO from the offtake tanker [460 m^3 released over 1 hour]) would be the worst-case spill for shoreline contact from Barossa Production Operations activities. Shoreline contact is predicted as a result of this scenario and therefore clean-up of shorelines is likely to be required. HFO can emulsify as its weathers, creating significant volumes of waste.

MDO and Barossa condensate are likely to be difficult to remove given their light nature, low residual fractions and high weathering potential (Appendix A). These products can be readily washed from sediments by wave and tidal flushing. The likely waste products from shoreline clean-up of a MDO or Barossa Condensate spill would be contaminated sand and debris.

Shoreline clean-up techniques include:

- **Shoreline Clean-up Assessment** – uses assessment processes (refer Northern Australia OSM-BIP [7715-650-ERP-0003]) to assess shoreline character, assess shoreline oiling and develop recommendations for response. Typically, this should be the first step in any shoreline clean-up response
- **Natural Recovery** – oiled shorelines are left untreated and the oil naturally degrades over time
- **Manual and Mechanical Removal** – removes oil and contaminated materials using machinery, hand tools, or a combination of both
- **Washing, Flooding and Flushing** – uses water, steam, or sand to flush oil from impacted shoreline areas

- **Sediment Reworking and Surf Washing** – uses various methods to accelerate natural degradation of oil by manipulating the sediment.

15.2 Implementation guidance

Table 15-1 lists the environmental performance outcome and initiation and termination criteria for this strategy. Table 15-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 15-3 lists resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial shoreline clean-up operations, unless directed otherwise by the relevant Control Agency, are listed in Table 15-4. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 15-2: Implementation guidance – shoreline clean-up

	Action	Consideration	Responsibility	Complete
Initial Actions	**Actions below are indicative only and are at the final determination of the Control Agency**			
	Initiate Shoreline Clean-up Assessment (if not already activated).	Refer to Northern Australia OSM-BIP (7715-650-ERP-0003) for additional information. UAVs may be necessary for some sensitive environments and where personnel safety is at risk (e.g. dangerous fauna in remote locations).	Environment Unit Leader	☐
	Using results from Shoreline Clean-up Assessment, conduct operational NEBA to assess shoreline clean-up suitability and recommended tactics for each shoreline location.	Shoreline Clean-up Assessment Teams are responsible for preparing field maps and forms detailing the area surveyed and make specific clean-up recommendations. The condition of affected shorelines will be constantly changing. Results of shoreline surveys should be reported as quickly as possible to the IMT to help inform real-time decision-making. Engage a Heritage Advisor if spill response activities overlap with potential areas of cultural significance.	Environment Unit Leader	☐
	If operational NEBA supports shoreline clean-up, prepare a Shoreline Clean-up Plan for inclusion in the IAP.	Shoreline Clean-up Plan may include: • clean-up objectives • clean-up end points (may be derived from Shoreline Clean-up Assessment) • clean-up priorities (may be derived from Shoreline Clean-up Assessment) • assessment and location of staging areas and worksites (including health and safety constraints, zoning) • utility resource assessment and support (to be conducted if activity is of significant size in comparison to the size of the coastal community) • permits required (if applicable) • chain of command for on-site personnel • list of resources (personnel, equipment, personal protective equipment) required for selected clean-up tactics at each site • details of accommodation and transport management • security management • waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes • establish no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (use existing roads and tracks first) • shift rotation requirements.	Environment Unit Leader Planning Section Chief Operations Section Chief	☐

	Action	Consideration	Responsibility	Complete
		Refer to IPIECA guide: A Guide to Oiled Shoreline Clean-up Techniques (IPIECA-IOGP, 2016b) for additional guidance on shoreline clean-up planning and implementation.		
	In consultation with the Control Agency, procure and mobilise resources to a designated port location for deployment, or directly to location via road transport.	-	Logistics Section Chief Supply Unit Leader	☐
	Deploy shoreline clean-up response teams to each shoreline location to begin operations under direction of the Control Agency.	Each clean-up team to be led by a Shoreline Response Team Leader, who could be an AMOSC Core Group Member or trained member of the AMSA administered National Response Team. Clean-up teams and equipment will be deployed and positioned as per those observations by the Shoreline Clean-up Assessment Teams in consultation with the Control Agency. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change.	Operations Section Chief Logistics Section Chief	☐
Ongoing Actions	Shoreline Response Team Leader shall communicate daily reports to the IMT Operations Section Chief to inform of effectiveness of existing tactics and any proposed tactics and required resources.	Where possible, maintain some consistency in personnel within Shoreline Response Teams. If the same personnel are involved in Shoreline Clean-up Assessment and clean-up, they will be better placed to adapt their recommendations as the clean-up progresses and judge when the agreed end points have been met.	Shoreline Response Program Manager Operations Section Chief	☐
Ongoing Actions	The IMT Operations Section Chief shall work with the Planning Section Chief to incorporate recommendations into the IAPs for the following operational period, and ensure all required resources are released and activated through the Supply Unit Leader and Logistics Section Chief.	-	Operations Section Chief Planning Section Chief	☐
Ongoing Actions	Monitor progress of clean-up efforts and report to the Control Agency.	-	Operations Section Chief On-Scene Commander Deputy OSC (Control Agency FOB)	☐

Table 15-3: Shoreline clean-up – resource capability

Equipment type/ personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
Manual clean-up tools (shovels, rakes, wheelbarrows, bags, etc.)	AMOSC shoreline kits	Boom Accessories-Beach Guardian Deployment Kit Total – 14	Fremantle – 2 Geelong – 8 Broome – 1 Exmouth - 3	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call; equipment logistics varies according to stockpile location (Table 10-12)
	Hardware suppliers	As available	Karratha / Exmouth / Perth	-
Shoreline flushing (pumps/hoses)	AMOSC	Shoreline flushing kit 3″ Total – 2	Fremantle –1 Geelong – 1	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see Table 10-12
		Shoreline flushing kit 4″ Total – 1	Geelong – 1	
		Shoreline impact lance kit Total – 1	Geelong – 1	
Nearshore booms/ skimmers	AMOSC AMSA Industry Mutual Aid	Refer to Protection and Deflection (Table 14-3)	-	-
Decontamination/staging site equipment	AMOSC	Decontamination kit (PPE) Total – 3	Broome –1 Exmouth –1 Geelong – 1	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see Table 10-12
		Decontamination kit Locker Total – 3	Exmouth – 1 Fremantle – 1 Geelong – 1	
		Decontamination – vehicle washdown trailer Total – 2	Fremantle – 1 Geelong – 1	
		Decontamination – Decon. Support trailer Total – 1	Geelong – 1	
	AMSA	Decontamination station	Darwin – 1	Access to National Plan equipment[45] through AMOSC[46].

[45] *Updated AMSA Equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal - https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[46] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources*

Equipment type/ personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
		Total – 5	Karratha –2 Fremantle – 2	Equipment mobilisation times vary according to stockpile location.
	Oil spill equipment provider (e.g. Global Spill., PPS)	As available	Perth	Subject to availability
Waste storage (including temporary storage and waste skips and tanks for transport)	AMOSC temporary storage	Fast tanks (9,000 L and 3,000 L) Total – 8	Geelong – 4 Fremantle – 2 Exmouth – 2	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see Table 10-12
		Vikotank (13,000 L) Total – 2	Broome – 1 Geelong – 1	
		Lamor (11,400 L) Total – 4	Fremantle – 4	
		IBCs (1 m^3) Total – 18	Geelong – 18	
	AMSA temporary storage	Fast tanks – (10 m^3) Total – 22	Darwin – 2 Karratha – 2 Fremantle – 4 Adelaide – 1 Brisbane – 2 Devonport – 2 Melbourne – 1 Sydney – 4 Townsville – 4	Access to National Plan equipment through AMOSC Equipment mobilisation times vary according to stockpile location.
		Structureflex – (10 m^3) Total – 3	Brisbane – 1 Adelaide – 2	
		Vikoma – (10 m^3) Total – 20	Darwin – 2 Adelaide – 1 Brisbane – 1 Devonport – 2 Fremantle – 4 Fremantle – 3 Melbourne – 2 Sydney – 2	

Equipment type/ personnel required	Organisation	Equipment specifications / total quantity available	Location / quantity available	Mobilisation timeframe
			Townsville – 4	
	Santos Waste Management Service Provider	Refer to Waste management (Section 17)	Perth, Karratha	<12 hours
Personnel (field responders) for OSR strategies	AMOSC staff	Total – 12	Fremantle – 5 Geelong – 7	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel depends on location of spill and transport to site
	AMOSC Core Group (Santos)	Total – 16	Perth/NW Australia facilities – 14 Port Bonython (South Australia) – 2	12+ hours <48 to NT locations
	Santos IMO1 personnel (Darwin)	6	Darwin	<24 hours to deployment port location
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility location across Australia	Location dependent. Confirmed at time of activation
	Santos-contracted workforce hire company (e.g. Dare)	As per availability (up to 2,000)	Australia-wide	Subject to availability (indicatively 72+ hours)

Table 15-4: Shoreline clean-up – first-strike response timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirms applicability of strategy and begins sourcing resources.	<4 hours
Santos Core Group mobilised to deployment port location.	<24 hours
Clean-up equipment mobilised to deployment port location.	<24–48 hours
Waste storage equipment mobilised to deployment port location.	<24 hours
Remote island transfer vessel (if required) mobilised to deployment port location.	<24 hours
AMOSC staff, Industry Core Group and Labour Hire mobilised to site/deployment port location.	<48 hours
Clean-up operation deployed to clean-up area under advice from Shoreline Assessment Team.	<60–72 hours (weather/daylight dependent)
Minimum resource requirements	
Note: Resource requirements for shoreline clean-up will be situation/receptor specific. TRPs are held by Santos and WA DoT and have been developed for various locations and are available on the Santos ER SharePoint page; A TRP will be developed for the Tiwi Islands, which is a Priority Protection Area for this activity, as further described in Section 6.6.1. Indicative minimum requirements for one Santos activated shoreline clean-up team are: • manual clean-up/shoreline flushing equipment kit • waste storage (bags, temporary storage tanks, skips as appropriate) • decontamination/staging equipment kit • personal protective equipment. One clean-up team comprises: • 1 team leader (AMOSC staff, Industry Core Group or Santos Core Group) • 10[47] shoreline clean-up responders (AMOSC Core Group, Santos-contracted labour hire personnel).	

15.3 Shoreline clean-up resources

Shoreline clean-up equipment available for use by Santos is a combination of Santos-owned, AMOSC, AMSA, and OSRL equipment as well as other industry resources available through the AMOSPlan mutual aid arrangements. Shoreline consumables are available through hardware, personal protective equipment (PPE) and specialist oil/chemical spill suppliers and mobile plant equipment is available through hire outlets in Darwin, Karratha, Broome, Perth and other regional centres. Where vessel deployments are required, Santos will leverage from existing contracted vessel providers in the first instance, and if required will source vessels from vendors that Santos already has a master service agreement with, or spot hiring vessels as needed. The Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) contains the specification for various types of vessel that may be required in an oil spill response, including vessels for shoreline clean-up support.

Shoreline clean-up personnel available to Santos is a combination of AMOSC staff, AMOSC Core Group Responders (comprising AMOSC trained Santos and Industry personnel), OSRL responders, Territory Response Team members and National Response Team members. Personnel for manual clean-up and mobile plant operation can be accessed through Santos' labour hire arrangements.

The level of deployment of equipment and personnel for clean-up will be commensurate to the spatial extent of shoreline contact, the volume of oil arriving and the sensitivity and access constraints of the shoreline in question. Deployment will be under the direction of the relevant Control Agency and the advice of shoreline clean-up specialists from AMOSC Core Group and National/Territory response teams. Shoreline clean-up assessments (refer to Northern Australia OSM-BIP [7715-650-ERP-0003]) will provide information to guide the clean-up strategy and deployment of resources.

15.4 Worst-case resourcing requirements

Worst-case shoreline clean-up requirements have been determined for affected shorelines based on deterministic run #99 (HFO spill - surface release of HFO from the offtake tanker [460 m^3 released over 1 hour]), which resulted

[47] *Remote islands and ecologically sensitive locations will have reduced personnel numbers to reduce impacts from clean-up operations (refer to Section 15.4.2)*

in the highest volume of shoreline accumulation ≥100 g/m^2. In addition, worst-case shoreline clean-up requirements for Australian shorelines have been determined, based on deterministic run #68 (surface release of MDO from a vessel [500 m^3 released over 1 hour]).). These worst-case personnel resourcing numbers for shoreline clean-up are provided as part of the cumulative resourcing assessment in Appendix Q.

For the deterministic run with the predicted highest volume of hydrocarbons on any shorelines (deterministic run #99 – HFO spill), it is estimated that clean-up operations would require a maximum of 15 teams (165 personnel) during the peak of operations. Although the HFO spill scenario is an instantaneous spill (released over 1 hour), HFO is a persistent product and weathers slowly. Therefore, a number of teams are expected to be required for continued clean-up operations following the timescales shown in Table 15-5. The deterministic run that predicted the highest volume of shoreline accumulation on Australian shorelines (run #68 – surface release of MDO from a vessel [500 m^3 released over 1 hour]), it is estimated a maximum of 3 teams would be required during the peak of clean-up operations, noting that MDO is a light hydrocarbon, weathers rapidly and is difficult to clean-up on sandy beaches due to its ability to penetrate porous sediments.

Resourcing requirements for shoreline oil operations have been conservatively determined based on a manual clean-up rate of 1 m^3 of oily waste per person per day. A bulking factor of 10 has been applied to manual clean-up activities (IPIECA-IOGP, 2016b). The resourcing estimate considers the size of a typical shoreline clean-up team (11 persons, comprising 1 Shoreline Clean-up Supervisor/ Incident Commander and 10 operatives).

Daily accumulation data from deterministic run #99 for the HFO spill scenario has been used to inform calculations for resourcing requirements as presented in Table 15-5. Daily accumulation represents the net volume of oil remaining on the shoreline following any daily oil arrival and daily oil removed through natural processes.

Note, this does not include all possible spill scenarios and a single spill may contact other receptors and at different volumes, as presented in Section 6.3. The information presented in Table 15-3 is to demonstrate that Santos can obtain the resources to scale up to the worst-case shoreline accumulation volumes. In the event of an incident, Santos would use initial monitor and evaluate data (e.g. trajectory modelling and aerial surveillance) to determine where the available resources should be allocated for an effective clean-up response.

15.4.1 Operational and environmental considerations affecting resourcing

Tidal ranges in the EMBA are large (7–8 m) and much of the coastline is remote and inaccessible by road, making many shoreline clean-up techniques difficult and their use may result in greater environmental impacts than the oil itself. In addition, the remote nature, potential presence of dangerous fauna (i.e. saltwater crocodiles and Irukandji jellyfish) present significant safety risks to responders working in these environments.

Large-scale operations involving large numbers of personnel may cause adverse environmental impacts at many of these sensitive shoreline locations. The constant removal of oil, even via manual removal, can result in a removal of substrate (e.g. sand, pebbles). If intrusive clean-up is conducted frequently, over a long period and along contiguous lengths of coastline, this may result in geomorphological changes to the shoreline profile and adverse impacts to shoreline invertebrate communities that provide an array of ecosystem services (Michel et al., 2017).

Given the safety constraints and ecological sensitivities of these shorelines, shoreline clean-up operations should be conducted by smaller teams for a longer time period. Intermittent manual treatment (<20 visits/month) and use of passive recovery booms is likely to be more effective than intrusive methods (e.g. intrusive manual removal >20 visits/month). Although clean-up may take longer, it is considered that the benefits outweigh the impacts as smaller teams are more targeted, recovering more oil and less sand and debris, reducing trampling of oil into the shore profile, and minimising ecological impacts on the shorelines and their sensitive species.

The number of shoreline clean-up teams recommended to treat these shorelines (as shown in Table 15-5 and Table 15-6) is not based on extensive, intrusive and contiguous removal of oil and waste along all shorelines, but rather on the use of fewer, smaller teams and at lower frequency of visits. If shoreline based manual removal is safe and deemed advantageous by shoreline clean-up assessment teams and operational NEBA, this should be conducted via land access (if possible) or via suitable vessels. However, it should be noted that it is generally not feasible to move response equipment into and out of mangroves, tidal flats and delta environments without causing excessive damage. Even foot traffic must be minimised, either by laying down wooden walkways or relying on vessel-based activities as much as possible (API, 2020). Santos has considered the access limitations, safety issues and number of clean-up teams that may be able to operate in each of these environments. A summary of these findings is presented below.

15.4.2 Remote island deployment

For shoreline clean-up of remote islands, the following process could be implemented so as to minimise the secondary impacts of high numbers of spill response personnel on shorelines. If shoreline contact is predicted with locations where TRPs exist, the TRP will be used to plan the deployment. Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, and WAMOPRA.

Vessels are to be mobilised to the designated deployment port to mobilise shoreline clean-up teams by water. The shoreline clean-up will be undertaken through on-water deployment to the defined shorelines in these stages:

1. Drop off 6-person clean-up containers (contents list in Appendix J) to shoreline contact locations defined by IMT through observation data; or if locations are too sensitive to be using as staging sites, then transfer equipment via landing barge for offsite staging.
2. Deploy marine and environmental specialists to demarcate the clean-up zones with barrier posts and tape to prevent secondary impacts to flora and fauna by the clean-up teams.
3. Deploy clean-up teams in 6-person squads with a trained/competent shoreline responder as a Team Leader to conduct clean-up methods (flushing, bag and retrieve, etc.) with all waste being bagged and stored in temporary bunding made of HDPE above the high-tide mark.
4. Deploy the waste pickup landing barges to retrieve collected wastes from the temporary bunding and to complete the shoreline clean-up and final polishing.

Multiple 6-person teams are to be used based on the actual volume of oil deposited, which will be determined via shoreline clean-up assessments (refer Northern Australia OSM-BIP [7715-650-ERP-0003]).

Safety note: *Due to the risk posed by unexploded ordnance, landing on Cartier Island or anchoring anywhere within the Cartier Island Marine Park is strictly prohibited without express prior written approval.*

If anchoring is unavoidable due to emergency (e.g. extreme weather conditions), great care should be taken to ensure anchoring is on sand, and anchors do not drag.

Any metal objects or suspicious objects found in the reserve should not be touched or disturbed and be reported immediately to the police and the Parks Australia Work Health and Safety Advisor on 02 6274 2369 or parkshealthandsafety@dcceew.gov.au.

Table 15-5: Requirements for shoreline clean-up for priority protection areas based on surface release of HFO from the offtake tanker (460 m^3 released over 1 hour) deterministic run #99 (RPS, 2023)

Time (day)	Volume of oil on shore (m^3) at PPAs predicted to be contacted by run #99		Total oil volume on shore (m^3)	Potential maximum waste generated (m^3) – bulking factor of 10†	Number of shoreline clean-up teams recommended (max 10 personnel/ team)	Maximum volume collected (m^3) by teams
	Indonesia East and Timor-Leste	Minor Indonesian islands				
Day 1–10ˣ	16.2	0	16.2	162	8	560
14	361.5	0.0	361.5	3,615	10-15	700-1,050
21	339.1	0.2	339.3	3,393	10-15	700-1,050
28	317.6	0.4	318.0	3,180	10-15	700-1,050
35	297.6	1.3	298.9	2,989	10-15	700-1,050
40	284.2	1.2	285.4	2,854	10-15	700-1,050*

× *Note – no shoreline contact before day 10.*

† *It will not be possible to remove the maximum waste volume from the shorelines within the first week – teams to remove in subsequent weeks.*

* *Teams to be retained following day 40 to help remove remaining volume of hydrocarbons that have not weathered or been removed by the previous weeks' clean-up activities.*

Table 15-6: Requirements for shoreline clean-up for Australian priority protection areas based on surface release of MDO from a vessel (500 m^3 released over 1 hour) deterministic run #68 (RPS, 2023)

Time (day)	Volume of oil ashore (m^3) at PPAs predicted to be contacted by run #68	Potential maximum waste generated (m^3/week) – bulking factor of 10	Number of shoreline clean-up teams recommended (max 10 personnel/ team)	Maximum volume collected (m^3/ week) by teams
	Tiwi Islands			
0–3	0	0	0	0
4–7	16	160	2-3	140-210
14	10	100	2-3	140-210
21	8	80	1-2	70-140
30	5	50	1-2	70-140

15.5 Shoreline clean-up decision guides

To help with planning, Appendix K provides guidance for selecting appropriate shoreline response strategies based on shoreline sensitivities.

Operational guidelines for shoreline response activities including worksite preparation, manual and mechanical oil removal and vessel access for remote shorelines are included in Appendix L**.**

The WA (DoT) Incident Management Plan – Marine Oil Pollution (WA DoT, 2023) also provides guidance on shoreline clean-up techniques.

15.6 Environmental performance

Table 15-7 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 15-7: Environmental performance – shoreline clean-up

Environmental performance outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
Shoreline Clean-Up	**Response preparedness**		
	Access to shoreline clean-up equipment and personnel	[EPS-SCU-001] Access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan, OSRL and TRG maintained throughout activity	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
			TRG Arrangements
	Access to Santos shoreline clean-up personnel	[EPS-SCU-002] Santos personnel available as per Table 15-3	Santos oil spill response team database
	Access to vessels suitable for remote island transfers of equipment, personnel and waste	[EPS-SCU-005] MSAs with multiple vessel providers maintained throughout activity	MSAs with multiple vessel providers Vessel details show suitability
	Vessel requirements for offshore island shoreline clean-up operations are identified	[EPS-SCU-006] Maintenance of vessel specification for remote island shoreline clean-up operations	Vessel Specifications within Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Access to shoreline clean-up labour hire personnel	[EPS-SCU-003] Maintenance of contract with labour hire provider	Labour hire contract
	Onboarding procedure to access shoreline clean-up labour hire personnel	[EPS-SCU-004] Maintenance of an onboarding procedure for oil spill response labour hire	Onboarding procedure
	Response implementation		
	First-strike capability mobilised	[EPS-SCU-007] First strike is mobilised in accordance with details and timings as specified in Table 15-4 unless directed otherwise by the Control Agency	Incident Log
	IMT and Control Agency to agree protection priorities	[EPS-SCU-012] Santos IMT to confirm protection priorities in consultation with the Control Agency	IAP Incident Log

Environmental performance outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
	Prepare operational NEBA to determine if shoreline clean-up activities are likely to result in a net environmental benefit	[EPS-SCU-013] Records indicate operational NEBA completed prior to shoreline activities commencing. Operational NEBA to be undertaken each operational period. Ensure NEBA considers waste management and the possibility of secondary contamination	Operational NEBA Incident Log IAP
	IAP Shoreline Clean-up Sub-plan is developed to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-015] IAP Shoreline Clean-up Sub-plan including waste management is developed to provide oversight and management of shoreline clean-up operation	Incident Log IAP Shoreline Protection and Deflection Sub-plan
	Shoreline clean-up operations will be implemented under the direction of the Control Agency to ensure effective and coordinated execution	[EPS-SCU-008] Clean-up strategies will be implemented under the direction of the Control Agency. Santos will make resources available to the Control Agency.	Incident Log
	Santos AMOSC Core Group responders available to the Control Agency for shoreline clean-up positions.	[EPS-SCU-016] Santos will make available AMOSC Core Group responders, or other appropriately trained responders, for shoreline clean-up team positions to the Control Agency.	Incident Log
	Equipment for shoreline clean-up made available to the Control Agency from Santos, AMOSC and OSRL stockpiles	[EPS-SCU-017] Santos will make available to the Control Agency equipment from AMOSC and OSRL stockpiles	Incident Log
	NEBA included in development of following operational period IAP	[EPS-SCU-014] Effectiveness of shoreline clean-up to be evaluated by team leaders and reported to IMT for inclusion in NEBA. NEBA undertaken every operational period by the relevant Control Agency to determine if response strategy is having a net environmental benefit. NEBA included in development of following period IAP	IAP Incident Log
	Access plans are developed to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-018] Access plans for shoreline operations will be developed. Unless directed otherwise by the Control Agency, Access plans will prioritise use of existing roads and tracks, establish demarcation zones to protect sensitive areas and select vehicles appropriate to conditions	IAP demonstrates requirement is met
	Soil profile assessment is undertaken prior to earthworks to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-020] Unless directed otherwise by the designated Control Agency, a soil profile assessment is conducted prior to earthworks	Soil Profile Assessment IAP Incident Log

Environmental performance outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
	Pre-cleaning and inspection of equipment (quarantine) is undertaken to minimise environmental impacts from response on offshore islands	[EPS-SCU-021] Vehicles and equipment provided by Santos are verified as clean and invasive species free prior to deployment to offshore islands	Quarantine documentation IAP Incident Log
	If spill response activities overlap with potential areas of cultural significance, a Heritage Advisor will be engaged	[EPS-SCU-022] In consultation with the Control Agency, engage a Heritage Advisor to provide advice on any sites of cultural significance that may be affected directly by the spill, or indirectly through implementation of spill response measures	Documented in IAP Incident Log
	Select forward staging areas in consultation with the Control Agency	[EPS-SCU-023] Any establishment of forward staging areas at shoreline areas done under direction or in consultation with the Control Agency	Incident Log IAP
	Establish demarcation zones in sensitive areas	[EPS-SCU-024] Unless directed otherwise by the Control Agency, demarcation zones are mapped out in sensitive habitat areas for vehicle and personnel movement, considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat	IAP demonstrates requirement is met
	Operational restrictions of vehicle and personnel movement are established to limit erosion and compaction	[EPS-SCU-019] Unless directed otherwise by the designated Control Agency, operational restrictions on movement of personnel and vehicles, including vehicle types and traffic volumes, are established to minimise impacts from erosion and compaction	IAP demonstrates requirement is met
	Stakeholder consultation for deployments in coastal areas	[EPS-SCU-025] Consultation is undertaken with relevant stakeholders prior to deployment of resources to townships and marine/coastal areas	Consultation records

16. Oiled wildlife response

Note: The NT Control Agency and WA DoT are the Control Agencies, and the NT DEPWS and WA DBCA are the Jurisdictional Authorities for OWR within NT and WA State waters, respectively. Santos and AMSA are the Control Agencies for OWR within Commonwealth waters from facility and vessel spills respectively.

Table 16-1 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 16-1: Oiled wildlife response – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement tactics in accordance with the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife
Initiation criteria	Monitor and evaluate information and/or operational monitoring data shows that wildlife are contacted or are predicted to be contacted by a spill
Termination criteria	• Oiling of wildlife has not been observed over a 48-hour period, and • Oiled wildlife have been successfully rehabilitated, and • Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response

16.1 Overview

The short-term effects of hydrocarbons on wildlife may be direct such as the external impacts from coating or internal effects from ingestion and inhalation. OWR includes wildlife surveillance/reconnaissance, wildlife hazing, pre-emptive capture, and the capture, cleaning, treatment, and rehabilitation of animals that have been oiled. In addition, it includes the collection, post-mortem examination, and disposal of deceased animals that are found in the vicinity of an oil spill or are reasonably suspected of having succumbed to the effects of oiling.

Long-term effects of a spill on wildlife may be associated with loss/degradation of habitat, impacts to food sources, and impacts to reproduction. An assessment of such impacts is covered in Section 7.7.6 of the EP and post-spill via scientific monitoring (Section 18).

Table 16-2 provides guidance on the designated Control Agency and Jurisdictional Authority for OWR in Commonwealth and Territory/State waters. For a petroleum activity spill in Commonwealth waters, Santos act as the Control Agency and will be responsible for the wildlife response. The Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) will be referred to for guidance for coordinating an OWR when Santos is the Control Agency and for the OWR first-strike response, otherwise the relevant Territory/State OWR Plan will be referred to, as described below.

16.1.1 Northern Territory waters and shorelines

The NTOWRP (AMOSC, 2019) is the key plan for OWR in the NT and provides operational OWR guidance during an incident resulting from a marine-based hydrocarbon spill due to petroleum activities within the NTOWRP area of operation. The NTOWRP is primarily designed to be used by the Titleholder as an operational OWR plan, but the plan also aims to provide operational guidance to any relevant government and non-government agencies located throughout the NTOWRP area of operation. The plan was developed by AMOSC and was commissioned by Shell Australia, ConocoPhillips and INPEX, and is consistent with regional OWR plans produced by AMOSC, DBCA (WA) and the Department for Environment and Water (DEW), South Australia (SA) (AMOSC, 2019).

The Parks and Wildlife Commission of the Northern Territory (PWC) is the Territory Government agency responsible for administering the *Parks and Wildlife Commission Act 2013*, which has provisions for the protection, conservation and sustainable use of wildlife. For Level 1 spills in Territory waters, Santos will be the Control Agency, including for wildlife response. For Level 2/3 petroleum activity spills, Santos will conduct the initial first-strike response actions for wildlife and continue to manage those operations until the relevant NT Control Agency is activated as the lead agency for OWR and a formal handover occurs. Following formal handover, Santos will function as a support organisation for the OWR and will be expected to continue to provide planning and resources as required when requested by the relevant NT Control Agency for OWR.

16.1.2 WA waters and shorelines

The key plan for OWR in WA is the WAOWRP (DBCA, 2022a). The WAOWRP establishes the framework for preparing and responding to potential or actual wildlife impacts during a spill and sets out the management arrangements for implementing an OWR in conjunction with the SHP-MEE. It is the responsibility of DBCA to administer the WAOWRP under the direction of the WA DoT (Table 16-2). The Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) is consistent with and interfaces the WAOWRP and WA Oiled Wildlife Response Manual (WA OWR Manual) (DBCA, 2022b).

If a spill occurs in WA State waters or enters State waters, DBCA is the Jurisdictional Authority for wildlife, and for Level 2/3 spills, will also lead the OWR under the control of the WA DoT. DBCA is the State Government agency responsible for administering the *Biodiversity Conservation Act 2016*, which has provisions for authorising activities that affect wildlife.

For Level 1 spills in WA State waters, Santos will be the Control Agency, including for wildlife response. It is however also an expectation that for Level 2/3 petroleum activity spills, Santos will conduct the initial first-strike response actions for wildlife and continue to manage those operations until DBCA is activated as the lead agency for wildlife response and formal handover occurs. Following formal handover, Santos will function as a support organisation for the OWR and will be expected to continue to provide planning and resources as required.

In this section, the WAOWRP (DBCA, 2022a) and WA OWR Manual (DBCA, 2022b) have been used to guide OWR planning. There is general support across industry to adopt the WAOWRP for use across Australia in the future. Meanwhile, the NTOWRP (AMOSC, 2019) will be used to provide OWR operational guidance during an incident in NT waters and shorelines.

Table 16-2: Jurisdictional and Control Agencies for oiled wildlife response

Jurisdictional boundary	Spill source	Jurisdictional Authority for OWR	Control Agency		Relevant documentation
			Level 1	Level 2/3	
Commonwealth waters (3–200 nautical miles from territorial/state sea baseline)	Vessel	DCCEEW	AMSA		WAOWRP WA OWR Manual
	Petroleum activities		Titleholder		
WA waters (State waters to 3 nautical miles and some areas around offshore atolls and islands)	Vessel	DBCA	WA DoT[48]		
	Petroleum activities		Titleholder	WA DoT	
NT waters (territorial sea baseline to 3 nautical miles and some areas around offshore atolls and islands)	Vessel	NT DEPWS	Vessel	NT IMT	NTOWRP
	Petroleum activities		Titleholder[49]	NT IMT[50]	
International waters[51]	Vessel	Relevant foreign authority	Santos will liaise with DFAT if an oil spill may enter international waters. Santos will work with DFAT and the respective governments to support response operations.		
	Petroleum activities				

16.2 Wildlife priority protection areas

For planning purposes, determining wildlife priority protection areas is based on stochastic modelling of the worst-case spill scenarios, the known presence of wildlife, and in consideration of the:

- presence of high densities of wildlife, threatened species, and/or endemic species with high site fidelity
- greatest probability and level of contact from floating oil and/or shoreline accumulation
- shortest timeframe to contact.

The wildlife priority protection areas for Barossa Production Operations activities are outlined in Table 16-3 and align with the priority protection sites for spill response described in Section 6.6.

In addition to the shorelines potentially contacted, the moderate exposure zone predicted from a worst-case Barossa Production Operations activity spill encompasses a large area of the Timor Sea. There is some evidence

[48] If an OWR is required in WA State waters, the DBCA is responsible for the administration of the WAOWRP under the direction of the WA DoT.

[49] Titleholder will be the control agency but will request approval of IAPs from the NT IC.

[50] NT IMT will be the control agency but will be supported by the titleholder (additional support from AMOSC if required).

[51] As per AMSA (2017b), Coordination of International Incidents: Notification Arrangements Guidance NP-GUI-007.

that foraging aggregations of seabirds, marine mammals and turtles occur within the Timor Sea (Lavers et al., 2014; Thums et al., 2017; Bouchet et al., 2020). However, there is generally a lack of data for this region—the exact location and any seasonal variation for such foraging aggregations remain largely unknown, although they are expected to be associated with banks and shoals.

Table 16-3: Wildlife priority protection areas

Wildlife priority protection area	Key locations	Key wildlife	Reference
Timor-Leste	Omai-Wetar Strait, Nino Konis Santana National Park, Tibar Bay	• Green Turtle (*Chelonia mydas*), Olive Ridley Turtle (*Lepidochelys olivacea*), Hawksbill Turtle (*Eretmochelys imbricata*), Leatherback Turtle (*Dermochelys coriacea*), Loggerhead Turtle (*Caretta caretta*) • Dugong (*Dugong dugon*) • Pygmy Blue Whale (*Balaenoptera musculus brevicauda*) • Sperm Whale (*Physetermacrocephalus*) • Orca (*Orcinus orca*) • High abundance and diversity of cetaceans • Saltwater Crocodile (*Crocodylus porosus*) • Shorebirds (including migratory shorebirds)	Trainor (2005) Democratic Republic of Timor-Leste (2015) Dethmers et al. (2009) Fossette et al. (2021) Sahri et al. (2022)
Timor	Taman Buru Bena, Teluk Kupang Marine Tourism Park, Menipo Nature Tourism Park, Maubesi Mangrove Forest Nature reserve	• Olive Ridley Turtle (*Lepidochelys olivacea*) nesting • Saltwater Crocodile (*Crocodylus porosus*) • Dugong (*Dugong dugon*) • High abundance and diversity of cetaceans • Shorebirds (including migratory shorebirds)	Mustika (2006) Trainor and Hidayat (2014) Dima et al. (2015) Saragih et al. (2020)
Maluku province of Indonesia	Wetar Island, Leti Island, Sermata Island, Babar Island, Tanimbar Islands, Burate Daya Islands	• Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*) • Dugong (*Dugong dugon*) • Pygmy Blue Whale (*Balaenoptera musculus brevicauda*) • High abundance and diversity of cetaceans	Suyadi et al. (2021)
Savu Sea	Rote Island, Savu Island Savu Sea Marine National Park	• Dugong (*Dugong dugon*) • Pygmy Blue Whale (*Balaenoptera musculus brevicauda*) migration route • Sperm Whale (*Physetermacrocephalus*) migration route • Orca (*Orcinus orca*) • High abundance and diversity of cetaceans • Feeding grounds and migratory corridors for cetaceans • Several species of marine turtle, including the Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*) and Leatherback Turtle (*Dermochelys coriacea*), have been recorded in the Savu Sea Marine National Park	Kahn (2002) Kahn (2003) Mustika (2006) Huffard et al. (2012)
Beagle Gulf–Darwin Coast	Tree Point Buffalo Creek Charles Darwin National Park	• Great Knot (*Calidris tenuirostris*), Greater Sand Plover (*Charadrius leschenaultii*), Bar-tailed Godwit (*Limosa lapponica*), Siberian Sand Plover (*Charadrius mongolus*), Red-necked Stint (*Calidris ruficollis*), various other shorebirds	AMOSC (2019)
	-	• Australian Snubfin Dolphin (*Orcaella heinsohni*) • Indo-Pacific Humpback Dolphin (*Sousa chinensis*) • Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*)	Groom et al. (2017)

Wildlife priority protection area	Key locations	Key wildlife	Reference
	Cox Peninsula East Point Reserve Rapid creek Lee Point	• Flatback Turtle (*Natator depressus*), Olive Ridley Turtle (*Lepidochelys olivacea*)	AMOSC (2019)
	-	• Saltwater Crocodile (*Crocodylus porosus*)	Fukuda and Cuff (2013)
Cape Hotham	Cape Hotham Adelaide River floodplain	• Great Knot (*Calidris tenuirostris*), Greater Sand Plover (*Charadrius leschenaultia*), Bar-tailed Godwit (*Limosa lapponica*), Lesser Sand Plover (*Charadrius mongolus*), Red-necked Stint (*Calidris ruficollis*), Little Curlew (*Numenius minutus*), Sharp-tailed Sandpiper (*Calidris acuminata*), various other shorebirds • Significant numbers of water birds found at Adelaide River floodplain	AMOSC (2019)
	-	• Dugong (*Dugong dugon*) • Australian Snubfin Dolphin (*Orcaella heinsohni*) • Indo-Pacific Humpback Dolphin (*Sousa chinensis*) • Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*)	Groom et al. (2017)
	-	• Saltwater Crocodile (*Crocodylus porosus*)	Fukuda and Cuff (2013)
Joseph Bonaparte Gulf – East Coast	Wadeye Coast Hyland Bay Moyle River Mouth Cape Dombey Mangrove Creek Little Moyle River Mouth Dooley Point Cape Scott Anson Bay Daly River Mouth Peron Island Channel Point Fog Bay Finnis River Mouth Five Mile Beach Windirr Island Bare Sand Island	• Support large numbers of migratory shorebirds during their non-breeding season, including internationally significant numbers of Greater Sand Plover (*Charadrius leschenaultia*), Grey-tailed Tattler (*Tringa brevipes*), Great Knot (*Calidris tenuirostris*), Terek Sandpiper (*Xenus cinereus*),Black-tailed Godwit *(Limosa limosa*). • Various other shorebird species	AMOSC (2019)
	Bare Sand Island	• White-winged Tern (*Chlidonias leucopterus*) and/or Whiskered Tern (*Chlidonias hybrida*)	AMOSC (2019)
	-	• Dugong (*Dugong dugon*) • Australian Snubfin Dolphin (*Orcaella heinsohni*) • Indo-Pacific Humpback Dolphin (*Sousa sahulenis*) • Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*)	Groom et al. (2017)
	-	• Saltwater Crocodile (*Crocodylus porosus*)	Fukuda and Cuff (2013)
	Wadeye Coast Dorcherty Island Anson Bay South Peron Island	• Green Turtle (*Chelonia mydas*), Olive Ridley Turtle (*Lepidochelys olivacea*), Flatback Turtle (*Natator depressus)*	AMOSC (2019)

Wildlife priority protection area	Key locations	Key wildlife	Reference
	Channel Point to Point Jenny Native Point to Five Mile Beach Bare Island Quail Island Indian Island		
Tiwi Islands	East of Cape Gambier to Shoal Bay South-west coast of Melville Island Buchanan Island West Bathurst Island Gordon Bay to Dudwell Creek Seagull Island NW tip Melville Island Johnson Point to Lethbridge Bay Lethridge Bay to Brenton Bay Point Jahleel Biradu Bay to Puloloo Bay	• Flatback Turtle (*Natator depressus*), Olive Ridley Turtle (*Lepidochelys olivacea*) and Green Turtle (*Chelonia mydas*) nesting	AMOSC (2019) IUCN (2023) Pendoley Environmental (2023)
	Puwanapi Seagull Island Lethbridge Bay Quanipiri Bay	• Shorebirds: Great Knot (*Calidris tenuirostris*), Red-necked Stint (*C. ruficollis*), Great Sand Plover (*Charadrius leschenaultii*), Bar-tailed Godwit (*Limosa lapponica*), Lesser Sand Plover (*Charadrius mongolus*), various other shorebirds • Seagull Island has the largest Crested Tern (*Thalasseus bergii*) colony (>30,000) in the NT	AMOSC (2019)
	-	• Saltwater Crocodile (*Crocodylus porosus*)	Fukuda and Cuff (2013)
Vernon Islands	-	• Low abundance for shorebirds and seabirds • Largely covered in mangroves	AMOSC (2019)
	-	• Dugong (*Dugong dugon*) • Australian Snubfin Dolphin (*Orcaella heinsohni*) • Indo-Pacific Humpback Dolphin (*Sousa chinensis*) • Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*)	Groom *et al*. (2017)
	-	• Saltwater Crocodile (*Crocodylus porosus*)	Fukuda and Cuff (2013)

16.3 Magnitude of wildlife impact

Given the distribution and behaviour of wildlife in the marine environment, a spill that only impacts Commonwealth offshore waters is likely to result in limited opportunities to rescue wildlife. During a 5-day rapid at-sea survey for megafauna conducted during the 2009 Montara oil spill, a high level of diversity and abundance of species were reported within the oil spill region in the Timor Sea, including ~2,800 birds, 462 cetaceans, 25 turtles and 62 sea snakes. Despite the large numbers of wildlife observed, only one dying Common Noddy (*Anous stolidus*) and one dead Horned Sea Snake (*Acalyptophis peronii*) were observed and recovered at sea, in spite of the survey covering a distance of 1,238 km and a total survey area of 99,040 ha (Watson et al. 2009). For offshore spills that do not result in shoreline contact, continued wildlife reconnaissance for rescue opportunities, carcass recovery, sampling of carcasses that cannot be retrieved, and OSM are more likely to be the focus of response efforts. In contrast, a spill that results in shoreline accumulation is likely to result in far greater wildlife impacts and opportunities to rescue wildlife.

The stochastic modelling for the worst-case spill scenarios for Barossa Production Operations activities shows that the probability of shoreline contact across all scenarios is relatively low (Section 6.3); however, if shoreline impact was to occur, it is predicted that high wildlife impacts are possible (using the WAOWRP [DBCA, 2022a] Guide for Rating the Wildlife Impact of an Oil Spill [Table 16-4]). There is also evidence that wildlife foraging aggregations occur in the Timor Sea that are most likely associated with banks and shoals, although their exact locations and seasonality remain largely unknown.

Table 16-4: WAOWRP guide for rating the wildlife impact of an oil spill (DBCA, 2022)

Wildlife impact rating	Low	Medium	High
What is the likely duration of the wildlife response?	<3 days	3–10 days	>10 days
What is the likely total intake of animals?	<10	11–25	>25
What is the likely daily intake of animals?	0–2	2–5	>5
Are threatened species, or species protected by treaty, likely to be impacted, either directly or by pollution of habitat or breeding areas?	No	Yes – possible	Yes – likely
Is there likely to be a requirement for building primary care facility for treatment, cleaning and rehabilitation?	No	Yes – possible	Yes – likely

16.4 Implementation guidance

Refer to Section 6 of the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) for guidance on the tasks and responsibilities that should be considered when implementing an OWR when Santos is the Control Agency or before formal handover to the relevant Control Agency. The OWR First Strike Implementation Guide within the Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) includes:

- Record keeping
- Situational awareness
- Activation of Santos IMT Wildlife Branch
- Notifications
- Santos Oiled Wildlife Rapid Assessment Teams (RATs)
- Wildlife Reconnaissance
- Santos Oiled Wildlife Sample Collection Protocol
- Mobilisation of required resources
- Handover to external Control Agency (if relevant).

The OWR first-strike plan will focus on notifications, wildlife reconnaissance and response preparation (refer to Section 6.1 of the Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017]). Refer to

Table 16-5 for an indicative timeframe for the OWR first-strike response and Appendix M for resource capability. Preventive actions, such as hazing, along with capture, intake and treatment require a higher degree of planning, approval (licences) and skills and will be planned for and carried out under the wildlife portion of the IAP (refer to Section 6.2 of the Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017]).

Table 16-5: Oiled wildlife response – first-strike response timeline

Task	Time from oiled wildlife contact (predicted or observed)
IMT notifies regulatory authorities and AMOSC of oiled wildlife / potential for contact	<2 hours
Mobilise Santos personnel for oiled wildlife reconnaissance **this will be already occurring through Aerial Observer mobilisation**	<24 hours
Mobilisation of AMOSC oiled wildlife equipment and industry OWR team to forward staging area	<48 hours

Task	Time from oiled wildlife contact (predicted or observed)
Minimum resource requirements	
The requirements for OWR will be situation-specific and depend upon reconnaissance reports. First-strike resources: • Reconnaissance platforms (Refer to Santos Oiled Wildlife Framework Plan [7700-650-PLA-001] and Appendix M) • 6 trained industry OWR team personnel (AMOSC staff and contractors/ AMOSC Industry OWR group) Additional resources: • Refer to Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) • Refer to Appendix M for information on OWR capability and equipment	

16.5 Environmental performance standards

Table 16-6 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 16-6: Environmental performance – oiled wildlife response

Environmental performance outcome	Implement tactics in accordance with Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
OWR	**Response preparedness**		
	Access to OWR equipment and personnel	[EPS-OWR-001] Access to OWR equipment and personnel through Santos, AMOSC, AMSA National Plan and OSRL maintained throughout activity as per Appendix M	Access to National Plan resources through AMSA AMOSC Participating Member Contract. OSRL Associate Member Contract.
	Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)	[EPS-OWR-005] Santos Oiled Wildlife Response Framework Plan provides guidance for coordinating an OWR when Santos is the Control Agency and outlined Santos's response arrangements	Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) Revision records
	Access to labour hire personnel	[EPS-OWR-003] Maintenance of contract with labour hire provider	Labour hire contract
	Labour hire onboarding procedure to access labour hire personnel	[EPS-OWR-004] Maintenance of an onboarding procedure for oil spill response labour hire	Onboarding procedure
	Access to Santos-trained OWR personnel	[EPS-OWR-002] Maintain Santos personnel trained on OWR and positioned at Perth and VI	Training records
	Response implementation		
	First strike capability mobilised	[EPS-OWR-006] First strike is mobilised in accordance with details and timings as specified in Table 16-5 unless directed otherwise by relevant Control Agency	Incident log
	OWR Management	[EPS-OWR-007] OWR managed in accordance with the Santos Oiled Wildlife Framework Plan (7700-650-PLA-0017)	Incident log
	Prepare operational NEBA prior to operations commencing	[EPS-OWR-008] Prepare operational NEBA to determine magnitude of wildlife impact and determine if OWR activities are likely to result in a net environmental benefit (particularly in	IAP Incident log

Environmental performance outcome	Implement tactics in accordance with Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
		relation to hazing and pre-emptive capture)	
	IAP OWR Sub-plan developed, including waste management, to provide oversight and management of OWR operations	[EPS-OWR-009] IAP OWR Sub-plan is developed to ensure effective, coordinated execution with the Santos Oiled Wildlife Framework Plan (7700-650-PLA-0017) and minimise environmental impacts from response	Incident log indicates IAP OWR Sub-plan prepared prior to OWR operations commencing
	Oiled Wildlife Sample Collection Protocol	[EPS-OWR-010] Oiled wildlife sample collection carried out in accordance with the Santos Oiled Wildlife Sample Collection Protocol	Incident log

17. Waste management

Table 17-1 lists the environmental performance outcome and initiation and termination criteria for this strategy.

Table 17-1: Waste management – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, re-using and recycling waste where possible		
Initiation criteria	Response activities that will be generating waste have been initiated		
Applicable hydrocarbons	**MDO**	**HFO**	**Barossa Condensate**
	✓	✓	✓
Termination criteria	• All waste generated from the oil spill response has been stored, transported and disposed as per the regulatory requirements, and • Agreement is reached with Jurisdictional Authorities to terminate the response		

17.1 Overview

The implementation of some spill response strategies will generate solid and liquid waste that will require rapid management, storage, transport and disposal. It is important that waste is collected and removed efficiently to ensure waste management does not create a bottleneck in response operations.

The type and amount of waste generated during a spill response will vary depending on the spill type/characteristics, volume released, and response strategies implemented. To account for this potential variability, waste management (including handling and capacity) needs to be scalable to allow a continuous response to be maintained.

Where Santos is the Control Agency, or at the request of the designated Control Agency, Santos will engage its contracted waste service provider (WSP) to provide sufficient waste receptacles to store collected waste and manage oily waste collection, transport and disposal associated with spill response activities. The WSP will arrange for all personnel, equipment and vehicles to carry out these activities from nominated collection points to licensed waste management facilities. All transport will be undertaken via controlled-waste-licensed vehicles and in accordance with the *Waste Management and Pollution Control Act 1998* (NT) in the NT jurisdiction; or the Environmental Protection (Controlled Waste) Regulations 2004 (WA) in the WA jurisdiction (noting the information provided in Section 4.6.3 regarding that it is unlikely that WA DoT arrangements will be implemented). Santos' Oil Pollution Waste Management Plan (BAA-201_0027) provides detailed guidance to the WSP in the event of a spill in its Northern Australia operational areas; and the Santos Oil Pollution Waste Management Plan (7715-650-ERP-0001) provides the equivalent detail for WA response operations.

17.2 Implementation guidance

Table 17-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. The Incident Commander is ultimately responsible for implementing the response, and therefore may determine that some tasks be varied, reassigned, or not be implemented.

Table 17-2: Implementation guidance – waste management

Action		Consideration	Responsibility	Complete
Initial actions	Contact WSP (Primary or Secondary Contact Person) and activate Waste Project Manager.	Refer to Incident Response Telephone Directory (SO-00-ZF-00025.020) for contact details.	Logistics Section Chief	☐
	Based on operational modelling and applicable response strategies communicate the type and quantity of empty liquid and solid waste receptacles required to support planned operations.	It is better to overestimate volumes and scale back resources then to underestimate waste volumes.	Logistics Section Chief Planning Section Chief	☐
	Using most recent monitor and evaluate data and any existing and future response activities, determine most suitable locations for waste receptacles to be positioned and for temporary storage locations to be established.	Shoreline waste collection points (temporary storage site) will be determined by the relevant Control Agency and will depend upon the location of shoreline clean-up activities and staging areas and the availability of vehicle access routes. Consideration would be given to positioning receptacles and locating temporary storage sites to ensure secondary contamination of sensitive receptors is avoided or minimised. The approval of temporary storage sites would be given through the NT DEPWS via the NT Environment Protection Authority for the NT jurisdiction; or DWER for the WA jurisdiction.	Logistics Section Chief Planning Section Chief Environmental Unit Leader	☐
	For each receival location indicate the anticipated: • material types • material generation rates • material generation quantities • commencement date/time • anticipated clean-up duration • receptacle types required • logistical support requirements • any approvals required from Ports, Local Governments, Landowners, State Government Agencies (Refer to Oil Pollution Waste Management Plan (BAA-201_0027)).	Consider facilities for waste segregation at source.	Logistics Section Chief Planning Section Chief	☐
	Once the above information is obtained, ensure all necessary waste management information is included in the IAP.	Waste management should be done in accordance with Santos' Oil Pollution Waste Management Plan (BAA-201_0027 for NT, 7715-650-ERP-0001 for WA); and where relevant, the *Waste Management and Pollution Control Act 1998* (NT); WA DoT Waste Management Guidelines (WA), the respective Port, Port Operator and/or Ship Owner's waste management plan.	Logistics Section Chief (or delegate) Planning Section Chief WSP location Responsible Person or Operations Supervisor	☐

Action		Consideration	Responsibility	Complete
	Mobilise waste management resources and services to agreed priority locations.	-	WSP location Responsible Person or Operations Supervisor Logistics Section Chief	☐
Ongoing actions	Provide ongoing point of contact between IMT and WSP.	If NT IMT is the Control Agency then the NT IMT shall advise the point of contact between them and the WSP. If WA DoT is the Control Agency, the Deputy Waste Management Coordinator shall be the point of contact between WA DoT and the WSP.	Logistics Section Chief	☐
	Ensure all waste handling, transport and disposal practices comply with legislative requirements.	Alert Logistics Section Chief (or delegate)/Deputy Waste Management Coordinator (if DoT is the Control Agency) if any non-compliance is anticipated or detected. Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (BAA-201_0027 for NT, 7715-650-ERP-0001 for WA); and where relevant, the *Waste Management and Pollution Control Act 1998* (NT); DoT Waste Management Guidelines (WA), the respective Port, Port Operator and/or Ship Owner's waste management plan.	WSP location Responsible Person or Operations Supervisor	☐
	Ensure records are maintained for all waste management activities, including but not limited to: • waste movements (e.g. types of receptacles, receival points, temporary storage points, final disposal locations) • volumes generated at each site (including total volume and generation rates) • types of waste generated at each site • approvals obtained (as required).	-	WSP location Responsible Person or Operations Supervisor	☐

17.3 Waste approvals

Site clean-up and removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (BAA-201_0027); and where relevant, the *Waste Management and Pollution Control Act 1998* (NT), the Environmental Protection (Controlled Waste) Regulations 2004 (WA) and WA DoT Waste Management Guidelines, and the respective port, port operator and/or ship owner's waste management plan. In addition, regulatory approval may be required for the temporary storage, transport, disposal and treatment of waste, through the NT Environment Protection Authority (EPA) or WA DWER.

The DEPWS administers the *Waste Management and Pollution Control Act 1998* (NT) and DWER administers the *Environmental Protection Act 1986* (WA). The EPA is the relevant regulatory Authority for waste management approvals in the NT and DWER is the relevant authority in WA. For response operations in WA, the DoT may establish an Operational Area Support Group, as defined in the SHP-MEE, to request support from relevant WA Government Agencies, including DWER, during a WA State waters spill response. The relevant Santos Oil Pollution Waste Management Plan (BAA-201_0027 for NT and 7715-650-ERP-0001 for WA) provides detail on the regulatory requirements for each port/location likely to be used for waste management during any spill response operation associated with Santos' activities.

17.4 Waste service provider capability

Detailed guidance on Santos' WSP responsibilities for spill response waste management is provided in the Santos Oil Pollution Waste Management Plan (BAA-201_0027).

Key responsibilities of the WSP include:

- Maintain emergency response standby preparedness arrangements, including:
  - Have access to personnel, equipment and vehicles required for a first strike and ongoing response commensurate to Santos worse case spill and waste requirements.
  - Provide primary and secondary contact details for activation of spill response waste management services.
  - Have suitably trained personnel for completing critical tasks in spill response waste management.
  - Participate in exercises undertaken by Santos.
- Maintain ability to assist in the Control Agency's IAP and Waste Management Sub-plan process as required.
- Mobilise resources to waste collection points identified by the Control Agency.
- Ensure waste handling, transport and disposal practices meet legislative requirements.
- Keep auditable records of waste streams from collection points to final disposal points.
- Provide regular progress reporting to the Control Agency IMT and a final report relating to quantities and destinations of collected waste.
- Provide a project manager responsible for the rollout of spill response resources to meet spill response waste management objectives.
- Provide location-specific Operations Supervisor/s to handle on-site operational aspects (managing personnel and equipment, reporting, liaising with relevant field-based spill responders).

17.5 Waste management resources

Santos has access to capacity to deliver storage receptacles, remove, transport and dispose of all waste material from oil spill response activities to predetermined disposal points.

Table 17-3 lists waste service provider capability for waste removal and storage. The maximum weekly waste removal by shoreline clean-up teams (including bulking factor), evaluated in Table 15-5 is 1,050 m^3, which is exceeded by the waste service provider weekly waste storage and removal capacity specified in Table 17-3.

Table 17-3: NT waste service provider vehicle and equipment availability within Australia (as per Santos Waste Management Plan – Oil Spill Response Support [BAA-201_0027])

Plant and equipment	No. / No. of containers per week	Capacity	Functionality	Uses per week	Indicative waste stored/shifted per week (m^3)
Waste removal					
Oily waste					
Hook Lift Truck	3	Lift up to 10 tonne, 11.6 m^3 per service	Servicing of skip bins	6	208
Hook Lift Truck	6		Servicing of skip bins	7	487
Front Lift Trucks	3	28 m^3 body, 11.2 m^3 per service	Servicing of front lift bins	6	201
Front Lift Trucks	6		Servicing of front lift bins	7	470
Flat Bed Truck	3	12 pallet spaces, 14 m^3 per service	Servicing of bins	6	252
Flat Bed Truck	4		Servicing of bins	7	392
Liquid waste (storage and/or removal)					
Waste collection vessel	2	20 kL	On-board liquid waste storage tank (decanting capability)	1	400
Road tanker	2	25 kL	Collection of liquid waste at the port of reception	1	500
Waste storage					
Oily waste					
Mobile Garbage Bin (MGB)	46	660 L	Various waste streams	6	182 (36.4 @ 5:1 compacted)
Mobile Garbage Bin (MGB)	56	660 L	Various waste streams	7	259 (51.7 @ 5:1 compacted)
Front Lift Bin	15	3 m^3	Various waste streams	6	270 (54 @ 5:1 compacted)
Front Lift Bin	15	3 m^3	Various waste streams	7	315 (63 @ 5:1 compacted)
Marrel Skip Bin	6	6 m^3	Various waste streams	6	216
Marrel Skip Bin	12	6 m^3	Various waste streams	7	504
Liquid waste					
Liquid waste IBCs	24	1	Storage of liquid waste on site	7	168
Forklift	2	4 tonne	All areas	Continuous	
Weekly waste storage capacity					**1,746**
Weekly waste removal capacity					**2,010**
Weekly liquid oil removal capacity					**900**

17.6 Environmental performance

Table 17-4 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 17-4: Environmental performance – waste management

Environmental performance outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, re-using and recycling waste where possible		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
Waste management	**Response preparedness**		
	Access to waste management equipment, personnel, transport and disposal facilities	[EPS-WM-001] Waste management sourced through contract with waste service provider. Contract with waste service provider to be maintained throughout activity.	Contract with WSP for emergency response services Annual desktop assurance report.
	Access to vessels for waste transport	[EPS-WM-002] MSAs with multiple vessel providers maintained throughout activity	MSAs with vessel providers
	Vessels requirements for containment and recovery waste transport are identified	[EPS-WM-003] Maintenance of vessel specification for waste storage and transport vessels for containment and recovery	Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Response implementation		
	Oil Pollution Waste Management Plan (BAA-201_0027 for NT and 7715-650-ERP-0001 for WA)	[EPS-WM-004] WSP shall: • Appoint a Project Manager within 24 hours of activation • Track all wastes from point of generation to final destination • Provide monthly waste management reports and more regular situation reports during the response until termination criteria are met	Incident log Waste tracking records
		[EPS-WM-006] WSP to provide liquid oil waste tanks for containment and recovery operations to deployment port, if requested, within 24 hours	Incident log
		[EPS-WM-007] WSP to provide waste bins for oil and oily waste for shoreline clean-up operations to clean-up site or deployment port, if requested, within 24 hours	Incident log

18. Operational and scientific monitoring

OSM is a key component of the environmental management document framework for offshore petroleum activities, which includes activity EPs and OPEPs. Operational monitoring is instrumental in providing situational awareness of a hydrocarbon spill, enabling the IMT to mount a timely and effective spill response and continually monitor the effectiveness of the response. Scientific monitoring is also the principal tool for determining the extent, severity and persistence of environmental impacts from a hydrocarbon spill and for informing resultant remediation activities.

Santos has developed a Northern Australia OSM-BIP (7715-650-ERP-0003), which describes a program of monitoring oil pollution that will be adopted in the event of a hydrocarbon spill incident (Level 2–3) to marine waters. It aligns with the Joint Industry Operational and Scientific Monitoring Framework (APPEA, 2021) and describes how this Framework applies to Santos activities and spill risks for the geographic extent of the Northern Australia OSM-BIP (7715-650-ERP-0003). The relationship between the Joint Industry OSM Framework and Santos environmental management framework is illustrated in Figure 18-1.

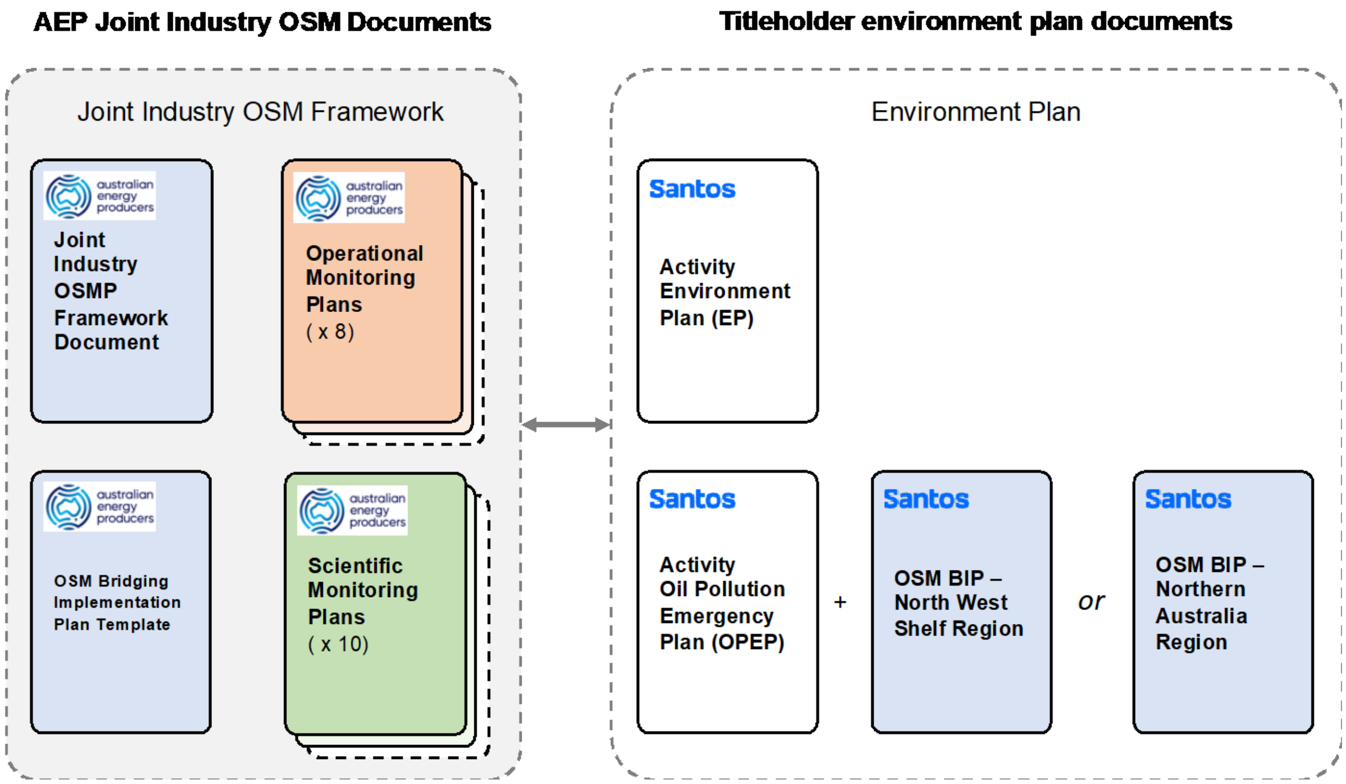


Figure 18-1: Relationship of Joint Industry and Titleholder OSM documentation

The Northern Australia OSM-BIP is structured so that it can provide a flexible framework that can be adapted to individual spill incidents. A series of Operational Monitoring Plans (OMPs) and Scientific Monitoring Plans (SMPs) form part of the Joint Industry OSM Framework and provide detail on monitoring design, standard operating procedures, data management, quality assurance and quality control and reporting.

There are 2 types of monitoring that would occur following a Level 2–3 spill event:

- **Operational Monitoring (OM** – which is undertaken during the course of the spill and includes any physical, chemical and biological assessments that may guide operational decisions such as selecting the appropriate response and mitigation methods and/or to determine when to terminate a response activity. This monitoring is additional to the activities (aerial/vessel surveillance, tracking buoys, oil spill trajectory modelling and satellite tracking) performed as part of the Monitor and Evaluate Strategy (Section 10). The design of operational monitoring requires judgements to be made about scope, methods, data inputs and outputs that are specific to the individual spill incident, balancing the operational needs of the response with the logistical and time constraints of gathering and processing information. Information needs to be collected and processed rapidly to suit response needs, with a lower level of sampling and accuracy needed than for scientific purposes. For details on initiation and termination criteria for OMPs refer to the Northern Australia OSM-BIP (7715-650-ERP-0003).
- **Scientific Monitoring (SM)** – which can extend beyond the termination of response operations. Scientific monitoring has objectives relating to attributing cause-effect interactions of the spill or associated response with changes to the surrounding environment. SM will be conducted on a wider study area, extending beyond the

spill footprint, will be more systematic and quantitative, and aim to account for natural or sampling variation. For further details on the SMPs refer to the OSM-BIP.

Table 18-1 lists the Joint Industry OMPs and SMPs that are relevant to Santos' Barossa Production Operations activities.

The Northern Australia OSM-BIP (7715-650-ERP-0003) is tailored to Santos' activities in the Timor Sea Region, north of Australia. It includes details on priority locations for monitoring, resourcing requirements; and operational guidance including logistics, mobilisation and permitting; with the exception of capability requirements for OMP: Shoreline Clean-up Assessment. The capability requirements for OMP: Shoreline Clean-up Assessment are typically assessed for each activity, according to deterministic modelling for the worst-case scenario that shows the simulation with the longest length of shoreline contacted, as this criterion influences the number of assessment teams required. Resourcing requirements for OMP: Shoreline Clean-up Assessment for the Barossa Production Operations activity are provided in Appendix O.

The capability assessment for the remaining OMPs and SMPs is assessed against different deterministic modelling criteria, as described in the Northern Australia OSM-BIP (7715-650-ERP-0003). The Northern Australia OSM-BIP (7715-650-ERP-0003) describes the methodology for assessing the worst-case OSM capability requirements for Santos activities in this region. In summary, Santos assessed the worst-case spill scenario for OSM capability as the scenario contacting the most receptors at the low thresholds at a probability >5% and within 7 days. Santos confirms that all the Barossa Production Operations spill scenarios (Section 6.1) fit within the OSM combined EMBA and assessment criteria defined within Appendix A of the Northern Australia OSM-BIP (7715-650-ERP-0003). Further, receptors contacted are all included within the baseline priority list in Section 2.2 of the Northern Australia OSM-BIP (7715-650-ERP-0003). This assessment is detailed in Appendix N.

Santos will review the initiation criteria for OMPs and SMPs (provided in Table 9-1 (OMPs) and Table 9-2 (SMPs) of the Joint Industry Operational and Scientific Monitoring Framework (APPEA, 2021)) during the preparation of the initial IAPs, and subsequent IAPs. If any initiation criteria are met, then that relevant OMP and/or SMP will be activated via the OSM Services Provider.

Table 18-1: Joint industry OSM plans relevant to Barossa Production Operations

Operational monitoring	Relevant for Barossa Production Operations	Scientific monitoring	Relevant for Barossa Production Operations
Hydrocarbon Properties and Weathering Behaviour at Sea	✓	Water Quality Impact Assessment	✓
Water Quality Assessment	✓	Sediment Quality Impact Assessment	✓
Sediment Quality Assessment	✓	Intertidal and Coastal Habitat Assessment	✓
Surface chemical dispersant effectiveness and fate assessment	✓	Seabirds and Shorebirds Assessment	✓
Subsea chemical dispersant effectiveness and fate assessment	×	Marine Mega-fauna Assessment	✓
Rapid Marine Fauna Surveillance	✓	Benthic Habitat Assessment	✓
Shoreline Clean-up Assessment	✓	Marine fish and elasmobranch assemblages assessment	✓
-	-	Fisheries Impact Assessment	✓
-	-	Heritage Features Assessment	✓
-	-	Social Impact Assessment	✓

18.1 Environmental performance

Table 18-2 lists the environmental performance outcome, control measures, performance standards and measurement criteria for OSM.

Table 18-2: Environmental performance – operational and scientific monitoring

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
	Response preparedness		
OSM – Preparedness	Maintenance of OSM Services Provider contract	[EPS-OSM-002] Maintain contracts with third-party provider/s to provide access to suitably qualified and competent personnel and equipment to assist in the implementation of monitoring	Contract with OSM Services Provider
	OSM Services Provider capability verified through regular capability reporting	[EPS-OSM-003] Obtain monthly capability reports from OSM Services Provider to demonstrate suitable resources are available throughout the activity	Monthly capability reports from OSM Services Provider
	Adequacy of existing baseline data sources across the Santos combined EMBA reviewed periodically	[EPS-OSM-004] Regular review of existing baseline data	Baseline data review report
	Water quality monitoring vessels	[EPS-OSM-006] Maintenance of vessel specification for water quality monitoring vessels within Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)	Vessel specification
	Access to Santos oil sampling kits	[EPS-OSM-001] Oil sampling kits pre-positioned at Darwin. Equipment contents as per the Santos Oil and Water Sampling Procedures (7710-650-PRO-0008) Appendix C	Evidence of deployment to site
	OSM Services Provider testing and exercising	[EPS-OSM-005] Annual testing of OSM Services Provider arrangements and capability	Exercise and testing records
	OSM-BIP reviewed annually	[EPS-OSM-030] Annual review of OSM-BIP	Record of revision
	Pre-completed risk assessment for OSM activities	[EPS-OSM-016] Pre-completed and approved risk assessment is in place with the OSM Services Provider for OSM activities	OSM Services Provider pre-completed and approved risk assessment
	Response implementation		
OSM – Activation and Mobilisation	Activate OSM plans	[EPS-OSM-010] OMPs and SMPs will be activated in accordance with the initiation criteria provided in Table 9-1 and 9-2 of the	IAP and Incident Log confirm OMPs and SMPs are activated in accordance with the initiation criteria provided in Table 9-1 and 9-

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
		Joint Industry OSM Framework (APPEA, 2021)	2 of the Joint Industry OSM Framework (APPEA, 2021)
	Activation of OSM plans according to OMPs and SMPs initiation criteria	[EPS-OSM-009] Initiation criteria of OMPs and SMPs will be reviewed during the preparation of the initial IAP and subsequent IAPs; and if any criteria are met, relevant OMPs and SMPs will be activated	IAP(s) Incident log
	OSM-BIP	[EPS-OSM-025] Monitoring to be conducted in accordance with the Santos Northern Australia OSM-BIP (7715-650-ERP-0003)	Incident log Monitoring records
	OSM implementation Minimum Standards	[EPS-OSM-026] Implementation of OSM will comply with the Minimum Standards listed in Appendix A of the Joint Industry OSM Framework (APPEA, 2021)	Incident log Monitoring records
	OSM Services Provider to commence activation within specified time from initial notification	[EPS-OSM-011] OSM Services Provider shall commence activation process within 30 mins of initial Call-off Order Form being received from Santos	OSM Services Provider records
	Santos to provide support to OSM Services Provider	[EPS-OSM-012] Santos personnel to support OSM Services Provider through the provision of monitor and evaluate information and relative location of sensitive receptors to the spill	Incident log OSM Services Provider records
	Mobilisation of appropriately specified monitoring vessels	[EPS-OSM-017] Source monitoring vessel(s) with specifications in accordance with Section 5.2 of Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)	Incident log
OSM – Water quality and dispersant amenability	Ecotoxicity testing of oil samples to take place	[EPS-OSM-007] Oil samples collected to be sent for laboratory ecotoxicity testing of oil	Incident log
	Ecotoxicity testing to derive species protection triggers	[EPS-OSM-008] 90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results (minimum 5 species' tests) within 24 hours of receiving all results	Ecotoxicity report from environmental contractor
	Dispersant amenability analysis of oil samples to take place	[EPS-OSM-029] If applicable (not MDO), oil samples sent to laboratory for dispersant amenability	Incident Log

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
OSM – Shoreline assessment and nearshore operations	Use of shallow draft vessels for shoreline and nearshore operations	[EPS-OSM-020] Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the relevant Control Agency	Vessel specification documentation contained in IAP
	Shoreline clean-up assessment direction and leadership	[EPS-OSM-018] OMP: Shoreline Clean-up Assessment will be implemented under the direction of the relevant Control Agency	Incident log
	SCAT Field Coordinator assessment/selection of vehicle appropriate to shoreline conditions	[EPS-OSM-021] SCAT Field Co-ordinator assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Conduct shoreline/ nearshore habitat/ bathymetry assessment	[EPS-OSM-022] Unless directed otherwise by the designated Control Agency, a rapid shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities	IAP records Assessment records
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat	[EPS-OSM-023] Unless directed otherwise by the designated Control Agency, demarcation zones are mapped out in sensitive habitat areas	IAP demonstrates requirement is met
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	[EPS-OSM-024] Unless directed otherwise by the designated Control Agency, action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met
	Daily SCAT reports issued during SCAT operations	[EPS-OSM-019] Reports from OMP: Shoreline Clean-up Assessment will be provided to the IMT daily, detailing the assessed areas to maximise effective utilisation of resources	Incident log
OSM – Stand-down and termination	Stand-down, termination and post-spill activities	[EPS-OSM-027] Once post-spill SMP monitoring reports are drafted they will be peer reviewed by an expert panel	Monitoring records
	Stand-down, termination and post-spill activities	[EPS-OSM-028] OMPs and SMPs will be terminated in accordance with the termination criteria provided in Tables 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)	IAP and Incident Log confirm OMPs and SMPs are terminated in accordance with the termination criteria provided in Tables 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)

19. Response termination

The decision to terminate the spill response is made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other Statutory Authorities that play an advisory role. This decision will be made with consideration of:

- the efficacy and benefit of current response options
- any potential for additional pollution
- any potential for additional environmental damage caused by further clean-up efforts
- an assessment of prevailing weather conditions that can increase risk to response teams or increase the efficacy in weathering hydrocarbon.

An operational NEBA will be conducted to inform the decision-making process. Termination criteria are defined within each section of contingency response activities defined in the OPEP.

Upon conclusion of the spill response activity, Santos will:

- prepare detailed reports and collate all documents
- report on the performance objectives of each individual spill response that was mobilised
- undertake an inventory of consumables and prepare accounts
- arrange the return of equipment
- arrange the refurbishment of consumed equipment
- investigate the cause of the incident and report to relevant authorities
- assess long-term environmental monitoring requirements.

20. References

Advisian (2018). Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Protection Priority Assessment for Zone 1: Kimberley – Draft Report. Report No: 301320-09591-EN-REP-0003– DOT307215. Prepared for Western Australian Department of Transport. Accessed 20 June 2024: https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_DOT307215_KimberleyProtectionPriorities.pdf

API. (2020). Oil Prevention and Response: Shoreline. Accessed 20th June 2024 - http://www.oilspillprevention.org/oil-spill-cleanup/shoreline-wetlands-beaches-oil-spill-cle.

Australian Marine Oil Spill Centre (AMOSC) (2019), Northern Territory Oiled Wildlife Response Plan, version 2.0, February 2019

AMOSC (2021), AMOSPlan Section III 2021 – Australian Industry Cooperative Oil Spill Response Arrangements [Internet, available: < https://amosc.com.au/wp-content/uploads/2021/10/amosplan-2021.pdf >].

AMOSC (2022), Fixed Wind Aerial Dispersant Operational Plan (FWADOps Plan), Version 1.1, 27 January 2022.

AMOSC (2024), AMOSC Core Group Program and Policies version 2.0, 2024.

AMSA (2017a). Australian Government Coordination Arrangements for Maritime Environmental Emergencies. Prepared by the Australian Maritime Safety Authority, October 2017.

AMSA (2017b). Coordination of International Incidents: Notification Arrangements Guidance. Guidance NP-GUI-007. Accessed 20th June 2024 - https://www.amsa.gov.au/sites/default/files/np-gui-007-coordination-of-international-incidents-notification-arrangements-guidance.pdf

AMSA (2017c). National Plan: Coordination of Domestic Cross-Border Incidents. Guidance Note NP-GUI-023. Prepared by the Australian Maritime Safety Authority. Version 1, updated March 2022. Accessed 20th June 2024 - https://www.amsa.gov.au/sites/default/files/np-gui-023-coordination-domestic-cross-border-incidents.pdf

AMSA (2020). National Plan for Maritime Environmental Emergencies. Australian Maritime Safety Authority, Canberra, Australian Capital Territory. Accessed 20th June 2024- https://www.amsa.gov.au/sites/default/files/amsa-496-national-plan.pdf

AMSA (2021a), Offshore petroleum industry advisory note; Advisory note for the offshore petroleum industry on environmental plans and oil pollution emergency plans, Accessed 20th June 2024- https://www.amsa.gov.au/safety-navigation/navigating-coastal-waters/offshore-activities/offshore-petroleum-industry-advisory

AMSA (2021b), National Response Team Policy (NP-POL-002), 21 February 2023, [Internet, available: < https://www.amsa.gov.au/marine-environment/national-plan-maritime-environmental-emergencies/np-pol-002-national-plan-0>].

AMSA (2022), Obtaining Approval to use an Oil Spill Control Agent at Sea or on a Shoreline, AMSA National Plan Supporting Documents [Internet, available: <https://www.amsa.gov.au/marine-environment/national-plan-maritime-environmental-emergencies/obtaining-approval-use-oil-spill>].

Australian Maritime Safety Authority (AMSA) (2023). Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities NP-GUI-012. Prepared by the National Plan Strategic Coordination Committee, January 2015, last updated August 2023.

Australian Petroleum Production and Exploration Association (APPEA) Limited (2021). Australian Offshore Titleholders Source Control Guideline. Rev 0 (approved). June 2021.

Bouchet, P. J., Letessier, T. B., Caley, M. J., Nichol, S. L., Hemmi, J. M., and Meeuwig, J. J. (2020). Submerged carbonate banks aggregate pelagic megafauna intropical Australia. Front. Mar. Sci. 7, 530. doi: 10.3389/fmars.2020.00530

CSIRO (2016). Oil Spill Monitoring Handbook. CSIRO Publishing.

Department of Biodiversity, Conservation and Attractions (DBCA) (2022a). Western Australian Oiled Wildlife Response Plan (WAOWRP) for Maritime Environmental Emergencies. Accessed 20th June 2024 at https://www.dpaw.wa.gov.au/management/marine/marine-wildlife/marine-wildlife-response?showall=&start=2

DBCA (2022b). Western Australian Oiled Wildlife Response Manual. Accessed 20th June 2024 at https://www.dpaw.wa.gov.au/management/marine/marine-wildlife/marine-wildlife-response?showall=&start=2

European Maritime Safety Agency (EMSA) (2010). Manual on the Applicability of Oil Spill Dispersants. Version 2.

Democratic Republic of Timor-Leste (2015). The National Biodiversity Strategy and Action Plan of Timor-Leste (2011-2020)

Dethmers K, Chatto R, Meekan M, Amaral A, de Cunha C, de Carvalho N, Edyvane K (2009). Marine megafauna surveys in Timor Leste: identifying opportunities for potential ecotourism – Final Report. Ministry of Agriculture & Fisheries, Government of Timor Leste.

Dima, A. O. M., Solihin, D. D., Manalu, W., Boediono, A. (2015) Multiple Paternity Detection of Olive Ridley Turtle, *Lepidochelys olivacea* Populations by Microsatellite Marker as a Genetic Conservation Strategy at Taman Buru Bena, Timor Island. International Journal of Sciences: Basic and Applied Research 22(1): 403-413.

European Maritime Safety Agency (EMSA) (2010). Manual on the Applicability of Oil Spill Dispersants. Version 2.

Faksness, L., Leirvik, F., Taban, I., Engen, F., Jensen, H., Holbu, J., Dolva, H. and Bratveit, M. Offshore field experiments with in-situ burning of oil: Emissions and burn efficiency. Environmental Research. Vol. 205. Article 112419.

Fossette, S., Ferreira, L., Whiting, S. D., King, J., Pendoley, K., Shimada, T., Speirs, M., Tucker, A., Wilson, W., Thumus, M. (2021), Movements and distribution of hawksbill turtles in the Eastern Indian Ocean. Global Ecology and Conservation 29, e01713. Accessed 20th June 2024 at https://doi.org/10.1016/j.gecco.2021.e01713

Fukuda, Y. and Cuff, N. (2013) Vegetation communities as nesting habitat for the saltwater crocodiles in the Norther territory of Australia. Herpetological Conservation and Biology 8(3): 641-651.

Groom RA, Dunshea GJ, Griffiths AD, and Mackarous K (2017). The distribution and abundance of Dugong and other marine megafauna in Northern Territory, November 2015. Department of Environment and Natural Resources, Darwin.

Hemmer, M.J., Barron, M.G. And Greene, R.M. (2011) Comparative toxicity of eight oil dispersants, Louisiana sweet crude oil (LSC), and chemically dispersed LSC to two aquatic test species. Environmental Toxicology and Chemistry, 30 (10), 2,244–52.

Hook, S. and Lee, K. (2015). Risk analysis of chemical oil dispersants on the Australian register. APPEA Journal 2015.

Huffard, C.L., M.V. Erdmann, and T.R.P. Gunawan (Eds). (2012). Geographic Priorities for Marine Biodiversity Conservation in Indonesia. Ministry of Marine Affairs and Fisheries and Marine Protected Areas Governance Program. Jakarta-Indonesia.

International Petroleum Industry Environmental Conservation Association (IPIECA) 2015, Dispersants: Surface application-Good practice guidelines for incident management and emergency response personnel. IPIECA-IOGP Report 532.

International Petroleum Industry Environmental Conservation Association – International Association of Oil and Gas Producers (IPIECA-IOGP) (2016a), At-sea containment and recovery; Good practice guidelines for incident management and emergency response personnel, IPIECA-IOGP Report 522. [Internet, available: < https://www.ipieca.org/resources/at-sea-containment-and-recovery >].

International Petroleum Industry Environmental Conservation Association – International Association of Oil and Gas Producers (IPIECA-IOGP) (2016b), A Guide to Oiled Shoreline Clean-up Techniques; Good practice guidelines for incident management and emergency response personnel, IPIECA-IOGP Report 521 [Internet, available: <https://www.ipieca.org/resources/good-practice/a-guide-to-oiled-shoreline-clean-up-techniques/>].

ITOPF (2023). ITOPF Members Handbook 2023. Prepared by International Tanker Owners Pollution Federation Ltd. Accessed 20th June 2024 - https://www.itopf.org/knowledge-resources/documents-guides/itopf-handbook/

Kahn, B. (2002) Visual and Acoustic Cetaceans Surveys and Evaluation of Traditional Whaling Practices, Fisheries Interactions and Naure Based Tourism Potential. WWF Indonesia, Wallacea Program, Alor and Solor.

Kahn, B. (2003) Solor-Alor Visual and Acoustic Cetacean Surveys. The Nature Conservancy SE Asia Centre for Marine Protected Areas and The Apex Environment, Solor-Alor.

Lavers, J. L., Miller, M. G. R., Carter, M. J., Swann, G., & Clarke, R. H. (2014). Predicting the Spatial Distribution of a Seabird Community to Identify Priority Conservation Areas in the Timor Sea. Conservation Biology, 28(6), 1699–1709. http://www.jstor.org/stable/24482133

McKinney, K. and Caplis, J. (2017) Evaluation of Oleophilic Skimmer Performance in Diminishing Oil Slick Thicknesses. International Oil Spill Conference Proceedings: May 2017, Vol. 2017, No. 1, pp. 1366-1381.

Michel, J., S. R. Fegley, J. A. Dahlin, and C. Wood. (2017). Oil spill response-related injuries on sand beaches: when shoreline treatment extends the impacts beyond the oil. Marine Ecology Progress Series 576:203–218.

Mustika, P. L. K. (2006) Marine Mammals in the Savu Sea (Indonesia): Indigenous Knowledge, Threat Analysis and Management Options. Thesis, James Cook University

NASEM (National Academies of Sciences, Engineering, and Medicine). (2020). The Use of Dispersants in Marine Oil Spill Response. The National Academies Press, Washington, DC, 340 pp., Accessed 20th June 2024 - https://www.nap.edu/catalog/25161/the-use-of-dispersants-in-marine-oil-spill-response

National Oceanic Atmospheric Administration (NOAA), US Coastguard, US Environmental Protection Agency (2006). Special Monitoring of Applied Response Technologies (SMART) monitoring protocol, Accessed 20 June 2024 - https://response.restoration.noaa.gov/sites/default/files/SMART_protocol.pdf.

NOAA. (2013). Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments. https://response.restoration.noaa.gov/sites/default/files/Characteristics_Response_Strategies.pdf

National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) (2018), At a glance – Oil spill dispersants, July 2018, [Internet, available: <https://www.nopsema.gov.au/sites/default/files/documents/2021-03/A626267.pdf>].

Northern Territory Government. 2021. Territory Emergency Plan. Accessed 20th June 2024: https://pfes.nt.gov.au/sites/default/files/uploads/files/2021/NTES_Territory_Emergency_Plan_2021.pdf

Offshore Energies UK (OEUK) (2024), Relief Well Planning for Offshore Wells Guideline, Issue 3, July 2024.

Pendoley Environmental (2023). Desktop Report: Tiwi Island Turtle Activity. Prepared for Santos Ltd.

Quigg, A., Farrington, J., Gilbert, S., Murawski, S., and John, V. (2021). A Decade of GoMRI Dispersant Science: Lessons Learned and Recommendations for the Future. Oceanography, Vol.34, No.1

RPS (2023). Santos Barossa Production Ops EP Hydrocarbon Spill Modelling Report. MAQ1197J. Rev 4.

Sahri A, Jak C, Putra MIH, Murk AJ, Andrews-Goff V, Double MC, van Lammeren, R. J. (2022), Telemetryt-based home range and habitat modelling reveals that the majority of areas important for pygmy blue whales are currently unprotected. Biol Conserv. 2022;272: 109594

Saragih, G. S., Kayat, Hidayatullah, M., Hadi, D. S. (2020) A preliminary study on the population and habitat of saltwater crocodile (*Crocodylus Porosus*) in Timor Island, East Nusa Tenggara. IOP Conf. Ser.: Earth Environ. Sci. 591 01204

Society of Petroleum Engineers (SPE) (2016), Technical Report on Calculation of Worst-Case Discharge (SPE-174705-TR) – SPE WCD Summit New Orleans March 2014 (Rev.1 September 2016).

Stacy NI, Field CL, Staggs L, MacLean RA and others (2017) Clinicopathological findings in sea turtles assessed during the Deepwater Horizon oil spill response. Endang Species Res 33:25-37. https://doi.org/10.3354/esr00769

Stevens, L. and Roberts, J. (2003). Dispersant Effectiveness on Heavy Fuel Oil and Crude Oil in New Zealand. International Oil Spill Conference Proceedings: April 2003, Vol. 2003, No. 1, pp. 509-513.

Suyadi, D. A., Nugroho, A. Irawan, D., Pelasula, D., Ruli, F., Islami, M. M., Alik, R., Tala, J., Pay, L., Matuankotta, C., Leatemia, A. S., Naroli, I. (2021) Biodiversity in the coastal ecosystems of small islands and it conservation status. IOP Conference Series: Earth and Environmental Science, 762, 012024

Thums, M., Waayers, D., Huang, Z., Pattiaratchi, C., Bernus, J., & Meekan, M. (2017). Environmental predictors of foraging and transit behaviour in flatback turtles *Natator depressus*. Endangered Species Research, 32(1), 333-349. https://doi.org/10.3354/esr00818

Trainor, C. R. (2005). Waterbirds and coastal seabirds of Timor-Leste (East Timor): status and distribution from surveys in August 2002-December 2004. Forktail 21: 61-78.

Trainor C. R. and Hidayat, O. (2014) Kupang Bay: an internationally significant wetland in West Timor, Indonesia. BirdingASIA 21: 45-50

Venn-Watson S, Colegrove KM, Litz J, Kinsel M, Terio K, Saliki J, Fire, S., Carmichael, R., Chevis, C., Hatchett, W., Pitchford, J., Tumlin, M., Field, C., Smith, S., Ewing, R., Fauquier, D., Lovewell, G., Whitehead, H., Rotstein, D., McFee, W., Fougeres, E., Rowles, T. (2015) Adrenal Gland and Lung Lesions in Gulf of Mexico Common Bottlenose Dolphins (*Tursiops truncatus*) Found Dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5): e0126538. https://doi.org/10.1371/journal.pone.0126538

WA DoT (2024). State Hazard Plan – Marine Environmental Emergencies (MEE). Department of Transport, Fremantle, Western Australia. [Internet, available: https://www.wa.gov.au/system/files/2024-08/state_hazard_plan_maritime_environmental_emergencies_2.03_0.pdf>].

WA DoT (2023), WA Incident Management Plan – Marine Oil Pollution, version 1.0, 4 September 2023 [Internet, available: <https://www.transport.wa.gov.au/mediaFiles/marine/MAR_P_WA_Incident_Management_Plan.pdf>].

WA DoT (DoT). (2020). Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements. Accessed 20th June 2024 at https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_Westplan_MOP_OffshorePetroleumIndGuidance.pdf

Wilkin SM, Rowles TK, Stratton E, Adimey N and others (2017) Marine mammal response operations during the Deepwater Horizon oil spill. Endang Species Res 33:107-118. https://doi.org/10.3354/esr00811

Appendix A Hydrocarbon characteristics and behaviour

Barossa Condensate

Barossa Condensate is characterised by a low viscosity and is considered a Group 1 oil (non-persistent) hydrocarbon, as per the grouping classification presented by AMSA (2023). If spilt on the sea surface, the condensate would rapidly spread and thin out resulting in a large surface area of hydrocarbon available for evaporation. The volatile component of Group 1 oils (non-persistent) tend to dissipate through evaporation within a few hours (ITOPF, 2023). Based upon the Barossa Condensate assay, up to 79% evaporated after 24 hours when on the sea surface, depending on weather conditions, sea state and time of year. Only 7% of the condensate is considered persistent, which would eventually breakdown due to the decay (RPS, 2023). Table A-1 summarises the physical characteristics of Barossa Condensate.

The fate of the condensate will depend greatly on the proportion that reaches the surface after rising through the water column (RPS, 2023). Condensate at surface will be subject to atmospheric weathering and will be transported by prevailing currents and wind. Condensate that entrains or dissolves in the water column will be transported by prevailing current and hence, will follow a different path. Condensate in the water column will also be subject to different weathering processes in comparison to floating condensate. Hence, discharge conditions (which affect droplet size distributions and rise times) will have a strong influence on exposure risks for surrounding resources (RPS, 2023).

Table A-1: Properties of Barossa Condensate (RPS, 2023)

Hydrocarbon type	Density at 16 °C (kg/m^3)	Dynamic viscosity at 10 °C (cP)	API	Component	Volatile (%)	Semi-volatile (%)	Low volatility (%)	Residual (%)
				BP (ºC)	<180	180–265	265–380	>380
Barossa Condensate	782	1.35	50.6	% of total	57	22	14	7

In summary, the condensate will behave as follows in the event of accidental release to the marine environment:

- Condensate will spread out rapidly on the sea surface to form a thin film. It will undergo rapid evaporation and is likely to generate high levels of airborne VOCs in the vicinity.
- Under calm wind conditions (Figure A-3), 79% of the condensate is predicted to evaporate within 24 hours. The remaining condensate on the water surface is predicted to weather at a slower rate due to the lower volatile components. Evaporation of the residual compounds is expected to slow considerably, and they will then be subject to more gradual decay through biological and photochemical processes.
- Under variable winds (Figure A-4), if the winds are of greater strength on average, entrainment of the condensate into the water column is predicted to increase. After 24 hours, 79% of the condensate mass is predicted to evaporate and 10% remains on the water surface. Due to the higher wind speeds and breaking waves, entrainment of the condensate into the water column is shown to occur.

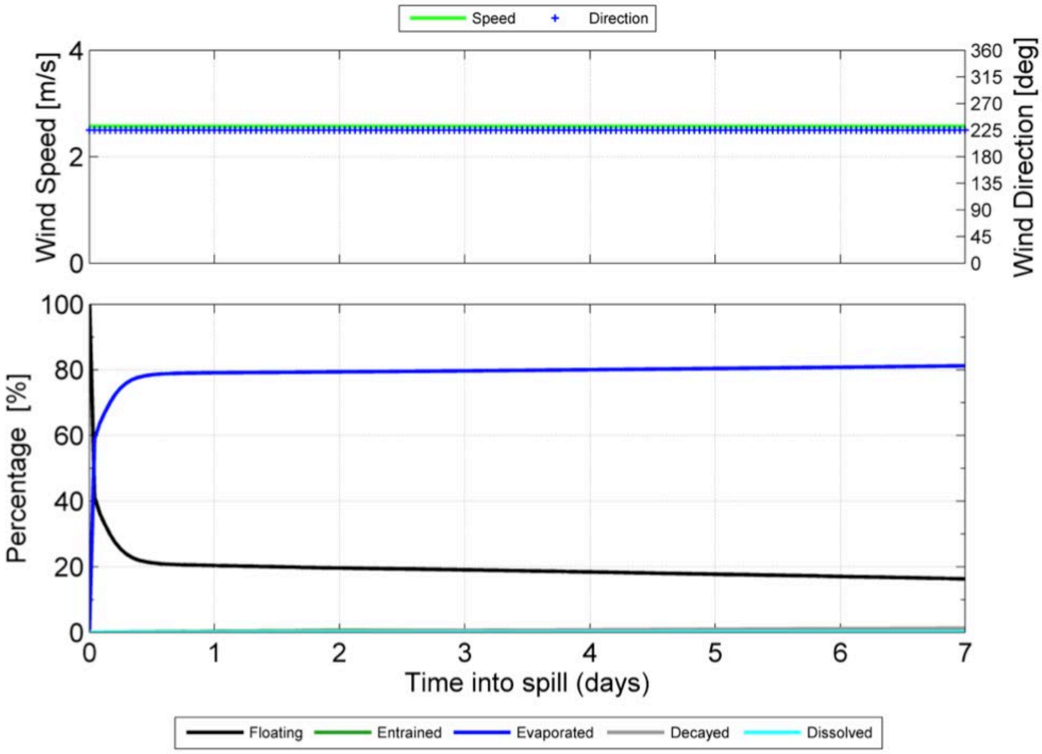


Figure A-1: Mass balance plot for an instantaneous surface release of Barossa Condensate subjected to a constant 5 knot (2.6 m/s) wind, currents and 27 °C water temperature (RPS, 2023)

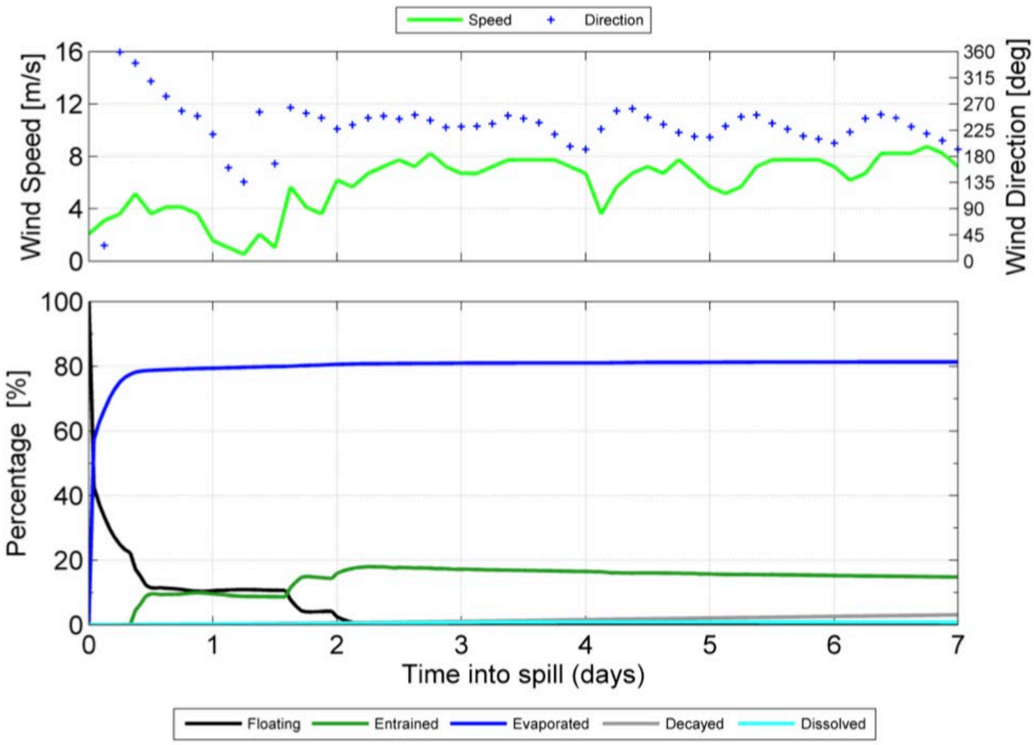


Figure A-2: Mass balance plot for an instantaneous surface release of Barossa Condensate subjected to variable wind speeds (1–12 m/s or 2–24 knots), currents and 27 °C water temperature (RPS, 2023)

Marine diesel oil (MDO)

MDO properties (Table A-2) classify it as Group 2 oil (light persistent) according to the AMSA (2023) and ITOPF (2023) classifications. In the marine environment, a 5% residual of the total quantity of MDO spilt will remain after the volatilisation and solubilisation processes associated with weathering. For full details on the properties of MDO, refer to Section 7.7.3.2 of the Barossa Production Operations Environment Plan – BAA-200 0637.

In summary, in the marine environment MDO will behave as follows:

- Diesel will spread rapidly in the direction of the prevailing wind and waves
- In calm conditions evaporation is the dominant process contributing to the fate of spilled MDO from the sea surface and will account for 60 to 80% reduction of the net hydrocarbon balance
- Has a strong tendency to entrain into the upper water column (0 m–20 m) (and consequently reduce evaporative loss) in the presence of moderate winds (>10 knots) and breaking waves. However, it re-surfaces when the conditions calm.
- The MDO evaporation rate will increase in warmer air and sea temperatures such as those present around the area
- Diesel residues usually comprise heavy compounds that may persist longer and will tend to disperse as oil droplets into the upper layers of the water column.

Generally, about 6.0% of the MDO mass should evaporate within the first 12 hours (Boiling point [BP] <180 °C); a further 34.6% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and an additional 54.4% should evaporate over several days (265 °C < BP < 380 °C). Approximately 5% (by mass) of MDO will not evaporate though will decay slowly over time.

Under constant winds (Figure A-3), ~41% of the MDO is expected to evaporate within 24 hours. Under variable winds (Figure A-4), where the winds are of greater strength on average, ~40% of the mass is predicted to evaporate, 31% is predicted to entrain and 29% remains on the water surface (RPS, 2023).

Table A-2: Properties of MDO (RPS, 2023)

Hydrocarbon type	Density (kg/m^3)	Dynamic viscosity at 25 °C (cP)	API	Component	Volatile (%)	Semi-volatile (%)	Low volatility (%)	Residual (%)
				BP (ºC)	<180	180–265	265–380	>380
MDO	829 at 25 °C	4	37.6	% of total	6	35	54	5

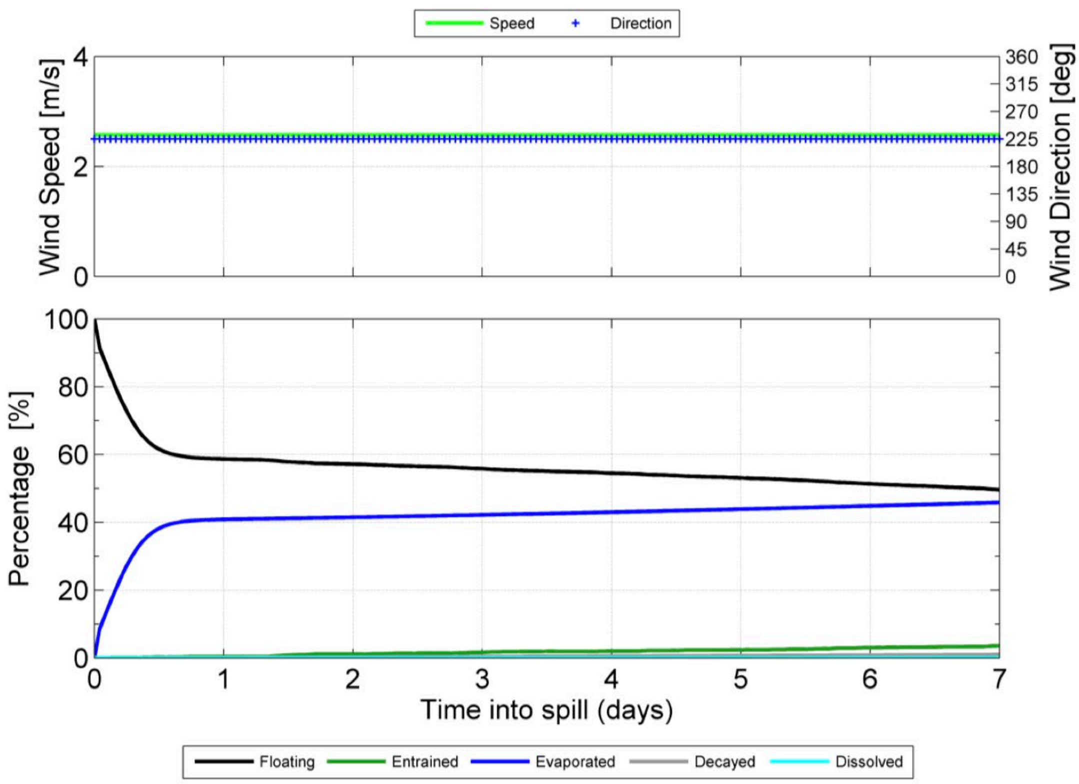


Figure A-3: Mass balance plot for an instantaneous surface release of MDO subjected to a constant 5 knot (2.6 m/s) wind, currents and 27 °C water temperature (RPS, 2023)

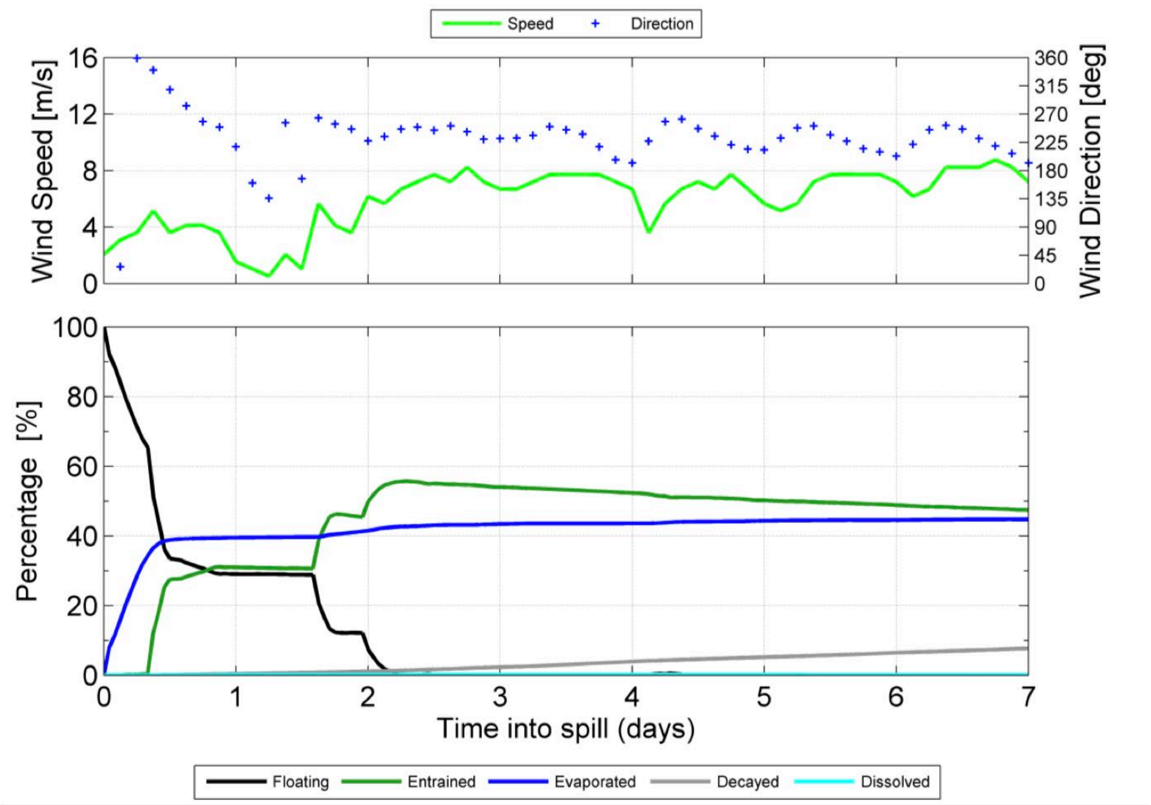


Figure A-4: Mass balance plot for an instantaneous surface release of MDO subjected to variable wind speeds (1–12 m/s or 2–24 knots), currents and 27 °C water temperature (RPS, 2023)

Heavy fuel oil (HFO)

HFO is characterised by a very high density at 974.9 (API Gravity of 12.3) and a high dynamic viscosity (3,180 cP @ 25 °C). HFO is considered a Group 4 (persistent heavy) hydrocarbon, as per the grouping classification presented by AMSA (2023). It is comprised of a high percentage of persistent components (82.8%), which will not evaporate. When spilt at sea the HFO will initially remain as a liquid as sea surface temperatures are above its pour point during all seasons. The volatile components (1%) are immediately lost via evaporation and the physical properties will change quickly as the lighter, more fluid, components evaporate and disperse through wind and wave action.

The residual component (~83%) of HFO is expected to become semi-solid to solid at ambient temperatures and is susceptible to decay over time. Previous weathering tests with HFO used as bunker fuels have shown that both the pour point and the viscosity of the oil increased with time (by an average of 2 orders of magnitude within 96 hours of weathering). Once the pour point of oil exceeded the seawater temperature (within 9–12 hours during all seasons) the oil weathered to a point where mostly solid non-spreading oil remained (up to 70% of bunker fuel remained as a solid residue even after the most extreme weathering tests).

Under calm and constant wind conditions (Figure A-5) after 24 hours, 6% of the HFO is predicted to evaporate and 93% remained floating on the sea surface. However, the region typically experiences moderate and variable wind conditions, represented in Figure A-6. Due to the high viscosity of HFO and its inability to spread to a thin sheen, the weathering test produced almost the same result as the constant wind case. At the conclusion of the simulations 7% of the HFO had evaporated during constant and variable wind cases, while 87% remained floating on the sea surface and ~6% was predicted to decay, at a rate of ~1% per day during both cases. (RPS, 2023)

Table A-3: Properties of HFO (RPS, 2023)

Hydrocarbon type	Density at 25 °C (kg/m^3)	Dynamic viscosity at 25 °C (cP)	API	Component	Volatile (%)	Semi-volatile (%)	Low volatility (%)	Residual (%)
				BP (ºC)	<180	180–265	265–380	>380
HFO	974.9	3,180	12.3	% of total	1.0	4.9	11.3	82.8

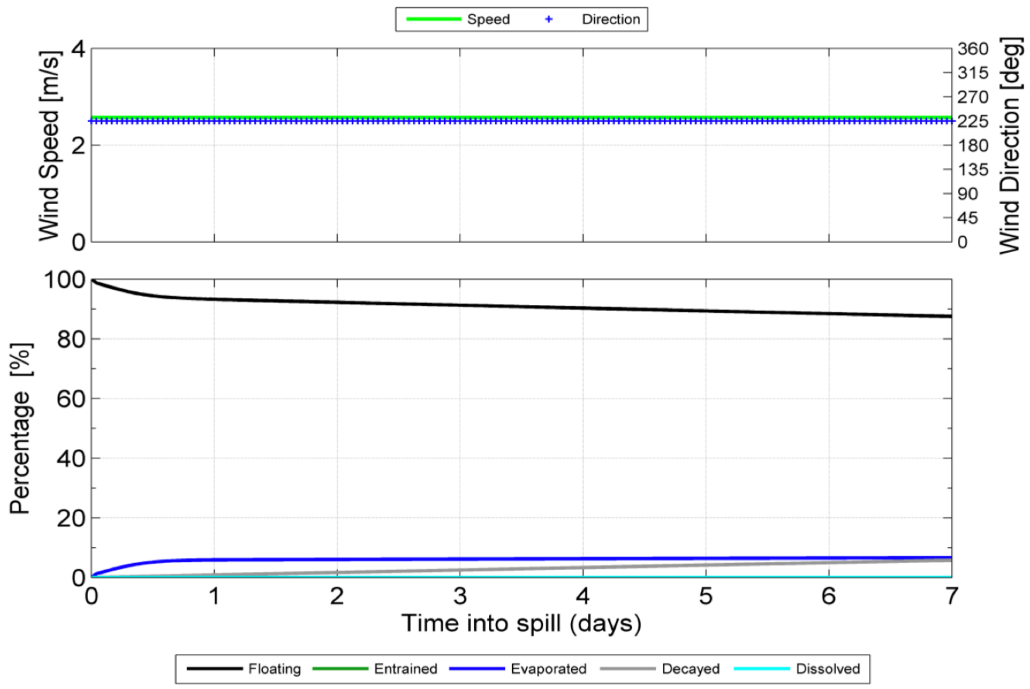


Figure A-5: Mass balance plot for an instantaneous surface release of HFO subjected to a constant 5 knot (2.6 m/s) wind, currents and 27 °C water temperature (RPS, 2023)

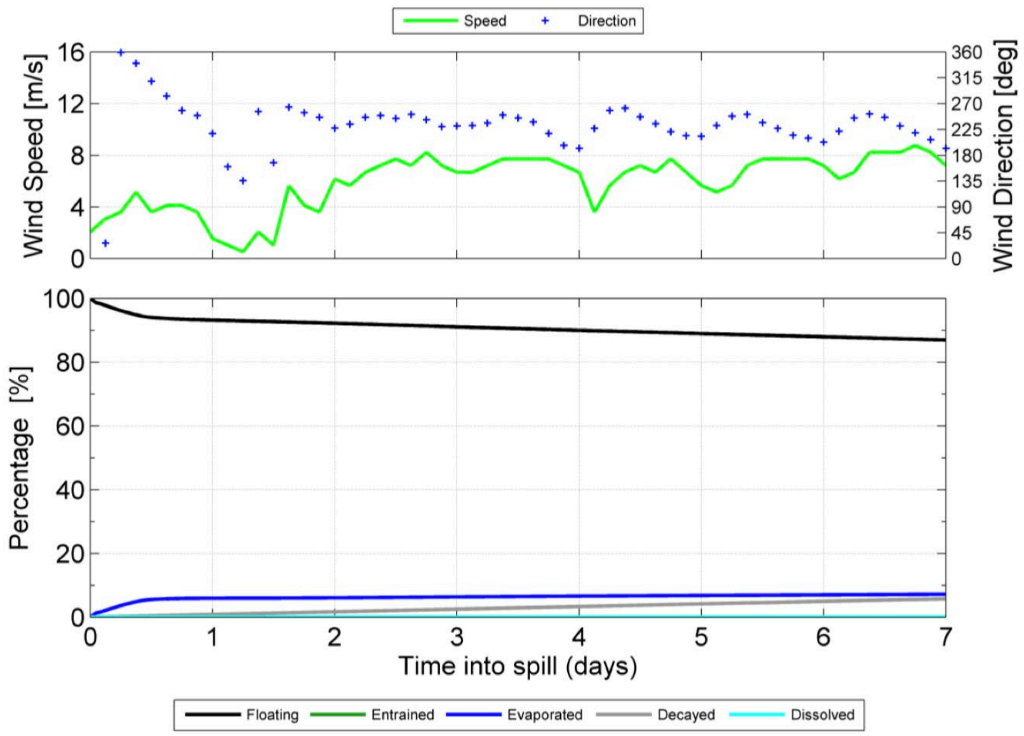


Figure A-6: Mass balance plot for an instantaneous surface release of HFO subjected to variable wind speeds (1–12 m/s or 2–24 knots), currents and 27 °C water temperature (RPS, 2023)

Santos

Appendix B Oil spill response ALARP framework & assessment

ALARP assessment framework

Rationale

As part regulatory approval requirements for petroleum activities, the Environment Plan (EP) and/or Oil Pollution Emergency Plan (OPEP) must demonstrate that by implementing all reasonable control measures, environmental risks have been reduced to a level that is as low as reasonably practicable (ALARP).

With respect to hydrocarbon spill risk and response planning, this includes an assessment to demonstrate that the oil spill response control measures are reducing risk to a level that is ALARP.

This ALARP Assessment Framework provides a process to identify all existing and potential spill response control measures, the selection or rejection of which are supported by reasoned arguments.

Guidance documents

Guidance documents used in preparing this framework include:

- Oil Spill Risk Assessment and Response Planning Procedure SO-91-II-20003
- NOPSEMA Guidance Note ALARP N-04300-GN0166, 1 August 2022
- NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271, June 2020
- NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721, January 2024
- NOPSEMA Guidance Note Risk Assessment GN0165, 24 June 2020
- NOPSEMA Oil Pollution Risk Management GN1488, 7 July 2021.

Overview

The ALARP Assessment Framework uses activity-specific information to systematically assess existing and potential control measures and ensure that all practicable control measures are identified and documented.

When selecting controls to reduce risk is it good practice to apply a preferential order; elimination, substitution, prevention, reduction and mitigation. In the context of this ALARP Assessment Framework for oil spill response, all control measures are response strategies to reduce the impacts of an unplanned event that has already occurred. All source control response measures may be classed as ‘reduction’ in the hierarchy of controls with all other response measures classed as ‘mitigation’.

The ALARP Assessment Framework is shown in Figure B-1.

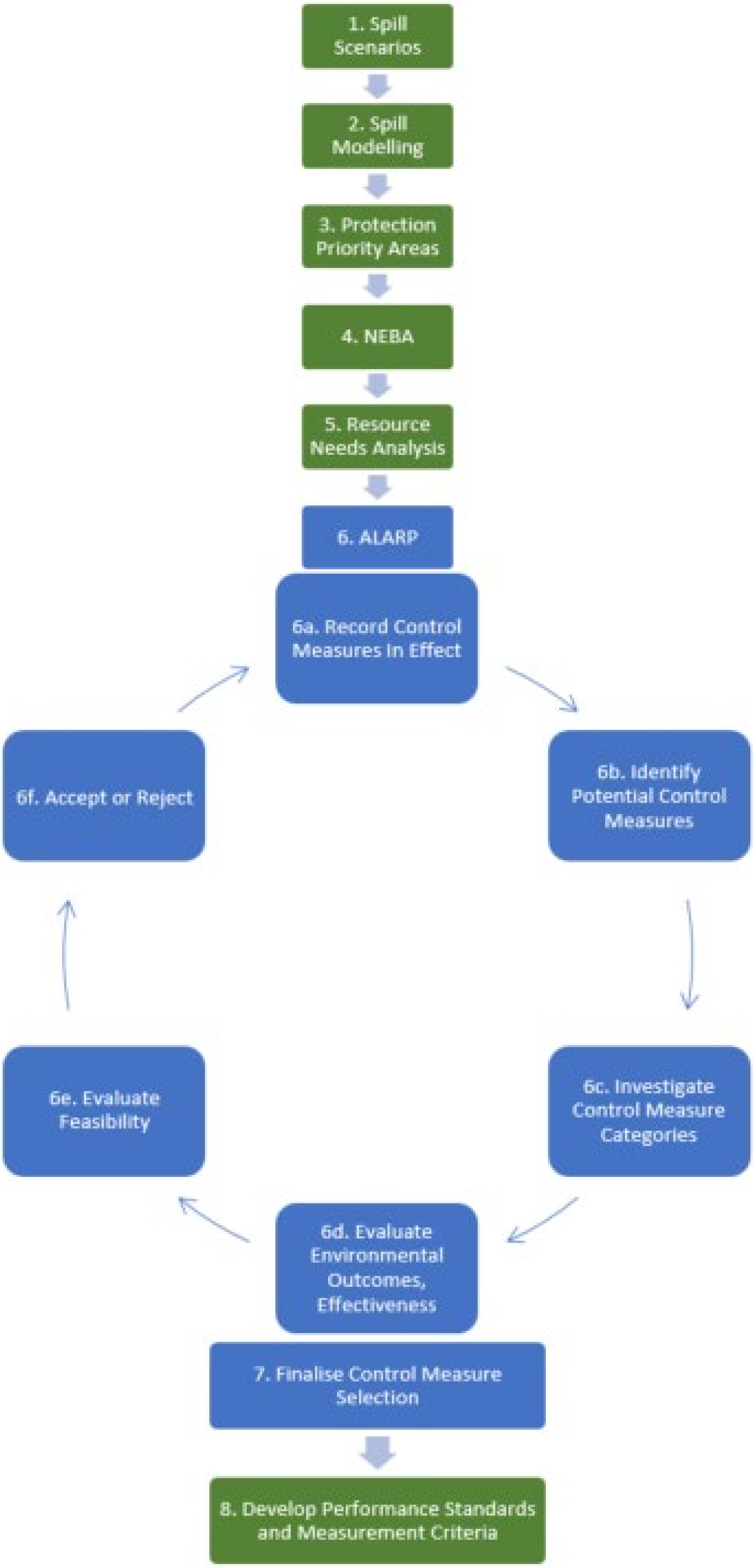


Figure B-1: ALARP assessment framework

In Figure B-1, Steps 1 to 5 (in GREEN) denote input information into the ALARP Assessment Framework. This information comprises:

1. **Spill Scenarios**: This step will involve assessing all possible spill scenarios from the activity and identifying the worst-case credible scenarios as a basis for pollution response planning.
2. **Spill Modelling**: A quantitative spill modelling assessment is conducted for the worst-case credible scenarios identified in Step 1.
3. **Protection Priority Areas**: The Environment that may be Affected (EMBA) is the largest area within which impacts from hydrocarbon spills associated with the activity could extend. The EMBA is predicted using spill modelling results from Step 2. Protection Priority Areas are locations of high ecological value within the EMBA that would be targeted in response. Selection of Protection Priority Areas is detailed in the Oil Spill Risk Assessment and Response Planning Procedure SO-91-II-20003
4. **NEBA**: Net Environmental Benefit Analysis (NEBA) is used to select the most effective response strategies to protect the Protection Priority Areas identified in Step 3.
5. **Resource Needs Analysis**: For the response strategies identified through NEBA, the worst-case resource, timing, and location requirements are determined, using quantitative spill modelling information where applicable. An Implementation Guidance is then developed to detail what arrangements and actions are required to be initiated by the Incident Management Team (IMT) to meet the incident requirements up to a worst-case incident.

Through the development of the Implementation Guidance, it may be possible to identify resource, timing and location requirements that could be improved. These areas of improvement should be noted in the ALARP so that additional, alternative or improved control measures can be considered in this context.

A detailed ALARP Assessment Framework for the evaluation of control measures is shown in Figure B-1, Step 6 (in BLUE). Criteria and definitions used to evaluate control measures are shown in Table B-1.

6. **ALARP assessment**:

   6a) Record Control Measures In Effect: The spill response control measures currently in place for Santos Offshore are listed here. The environmental outcomes and effectiveness of the in-effect control measures are noted, using the Resource Needs Analysis to assess whether there are any areas of improvement. Environmental outcomes include potential harmful effects of control measures.

   6b) Identify Potential Additional Control Measures: Potential control measures are identified, with a focus on any control measures that address areas of improvement identified in Step 6a.

   6c) Investigate Control Measure Categories: In-effect and potential control measures from Steps 6a and 6b are classified as either additional, alternative or improved, and as either people, system, equipment or procedures. This step serves as a prompt to ensure that potential control measures from all categories are explored.

   6d) Evaluate Environmental Outcomes, Effectiveness: The environmental outcomes and effectiveness are assessed for all control measures identified and described through Steps 6a, b, and c.

   6e) Evaluate Feasibility: Time, cost and effort required for implementation are assessed for all control measures identified and described through Steps 6a, b, and c.

   6f) Accept or Reject: The potential control measure will be accepted or rejected on the basis of environmental outcomes and effectiveness described in Step 6d and whether cost is grossly disproportionate, as described in Step 6e.

When evaluating potential control measures, implementation plans of in-effect control measures are carefully considered to ensure that any accepted control measures will equal or improve Santos capacity to meet resource needs. Potential control measures are also considered within the context of current Santos response arrangements to determine if synergies or resource conflicts might occur.

As control measures are evaluated for selection or rejection, they can be compared with industry good practice to ensure that all practicable control measures were implemented. Where unique circumstances exist and further analysis is required, a different evaluation technique may be used, such as technical analysis, detailed cost benefit analysis or combination of approaches.

New information on risks, impacts and response strategies obtained through analysis of operations, exercises and scheduled documentation reviews can be incorporated into the ALARP Assessment Framework cycle in a process of continual improvement.

In Figure B-1, Steps 7 and 8 show the conclusion of the ALARP Assessment Framework:

7. **Finalised Control Measure Selection**: Outputs from the ALARP Assessment shown in Step 6 comprise finalised control measures (in BLUE).
8. **Develop Performance Standards and Measurement Criteria**: For each control measure finalised in Step 7, performance standards and measurement criteria are then developed and documented in the OPEP (in GREEN).

Performance standards for all accepted control measures should be written to enable the operator to measure, monitor and test effectiveness. Only the key aspects of any given control will require performance standards and these may include the various measures of effectiveness; functionality, availability, reliability, survivability, dependency and compatibility. Parameters set in the performance standard should be 'SMART'; specific, measurable, appropriate, realistic and timely.

Corrective action, based on deviations or trends in performance, should be taken by amending the performance standard or the control measure, as appropriate.

Criteria and definitions

Standardised criteria and definitions are used to bring consistency to the ALARP assessment across diverse activities and response strategies. Criteria and definitions are shown in Table B-1.

Table B-1: Criteria and definitions of ALARP Assessment Framework

Column	Description
Strategy	Response Strategy
Control Measure	Aspect of Response Strategy being evaluated Description of the control measure that is In Effect or description of the potential control measure
In Effect, Alternative, Additional, Improved	In Effect control measures are already in place. Alternative control measures are evaluated as replacements for the control already in effect. Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures. Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures. Adapted from NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721, January 2024
Control Measure Category	A range of different types of controls generally provide effective protection as they provide independence and multiple layers of protection. The OPGGS (Safety) Regulations refer to technical and 'other' controls where technical control measures involve hardware like shutdown valves and alarms. 'Other' control measures include administrative and procedural control measures such as inductions, a drug and alcohol policy or an inspection regime. Industry practice has further developed this concept of a range of different types of controls based on a POiSTED framework to assess organisational capability: • People – personnel • System – organisation, information/communications, support facilities, training/ competency • Equipment – equipment • Procedures – doctrine Santos aims to implement a range of different types of controls where possible.
Environmental Outcomes	Assessment of environmental benefits, particularly those over and above those environmental benefits documented in the Control Measure that is in effect. Environmental impacts of the Control Measure are also considered here.
Effectiveness	The effectiveness of a Control Measure in reducing the risk to ALARP is evaluated using these criteria. **Functionality** • The functional performance of a control measure is what it is required to do. How does the control perform to achieve the required risk reduction? **Availability** • Probability that the control measure will be available when required and has not failed or is undergoing a maintenance or repair. **Reliability** • The reliability of a control measure is the probability that at any point in time it will operate correctly for a further specified length of time. Reliability is all to do with the probability that the system will function correctly and is usually measured by the mean time between failure.

Column	Description
	Survivability • Whether a control measure can survive a potentially damaging event such as fire or explosion is relevant for all control measures that are required to function after an incident has occurred. • To achieve their purpose, oil spill response control measures should have high survivability. However, some control measures, such as those involving equipment deployment from an FPSO would have low survivability in an incident that involves an FPSO explosion or fire. **Dependency** • The dependency of the control measure is its degree of reliance on other systems in order for it to be able to perform its intended function. If several control measures can be disabled by one failure mechanism (common mode failure), or the failure of one control measure is likely to cause the failure of others, then the control measures are not independent, and it may not be appropriate to count such measures as separate. • Several control measures are reliant on equipment, people and vessels, hence have high dependence. **Compatibility** • Whether a control measure is compatible takes into account how alternative control measures may interact with other controls and the rest of the facility, if introduced. Consideration should be given to whether new control measures are compatible with the facility and any other control measures already in use. Adapted from NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 Last Reviewed 2020
Feasibility	Feasibility describes the time, cost and/or effort required to implement the control measure.
Accept/ Reject	Outcome of assessment and key reasons for the decision

ALARP assessment summaries

ALARP assessment summary
Source Control
Control Measures in place for relief well drilling represent industry best practice and are considered to reduce the timeframe for drilling a relief well to as low as reasonably practicable (ALARP) in the context of the risk of an uncontrolled well leak during operations. Potential control measures were identified and assessed by the Santos Drilling & Completions department. The drilling of a relief well is considered to be an effective control and relief well planning conducted for the Barossa development wells has demonstrated that a MODU will be on site for relief well drilling by day 36 from report of a well release. Relief well drilling can be completed within 90 days using MODUs, equipment and specialist personnel that Santos has arrangements to gain access to. Four additional/alternative/improved control measures were identified and assessed. Two improved control measures were accepted as reasonably practicable: • Direct Surface Intervention Via Well Control Experts • Pre-purchase of relief well drilling supplies Two additional control measures were rejected as grossly disproportionate. Rejected control measures were: • Contract source control personnel through a provider in addition to existing arrangements • Wild Well Control Inc. on standby in Perth during drilling operations in order to respond immediately to a well leak The control measures in place for potential spills from project vessels , and/or from Barossa production facilities, represent industry best practice and will provide set procedures to follow in the event of a spill from project vessels or production facilities, thereby reducing the timeframe and increasing the effectiveness of spill response. Performance Standards and Measurement Criteria that have been developed for the in-effect control measures are shown in Table 9-10.
Monitor and evaluate
For the monitor and evaluate strategy, various, independent inputs from multiple service providers are used to build a detailed Common Operating Picture (COP) during the incident. Five potential alternative/ additional control measures were identified and assessed. One additional control measure was accepted as reasonably practicable. The accepted control measure was: • Position Santos-owned satellite tracking buoys on FPSO Four additional / alternative control measures were rejected as grossly disproportionate. Rejected control measures were: • Purchase of oil spill modelling system and internal personnel trained to use system

ALARP assessment summary
• Purchase of additional tracking buoys • Ensure trained aerial observers based at strategic locations such as Darwin • The 2 vessels that are in use by Santos servicing the Bayu-Undan operations could be used for surveillance purposes in response to a spill. Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted control measures are shown in Table 10-21.
Mechanical Dispersion
Mechanical dispersion is a secondary strategy that could be undertaken by vessels undertaking primary response strategies without the requirement for additional equipment. The use of mechanical dispersion as a response strategy would be assessed as part of an operational NEBA. No additional control measures were identified and assessed. Performance Standards and Measurement Criteria that have been developed for the in-effect control measures are shown in Table 12-4.
Surface Dispersant
Surface dispersant application is a secondary response strategy limited to the HFO spill scenario (surface release of HFO from the offtake tanker [460 m^3 released over 1 hour]) at the time of a spill and when deemed environmentally beneficial by an operational NEBA. Vessel-based dispersant spray systems are available from AMSA and mutual aid in the region (including AMSA and mutual aid stockpiles at Darwin) and nationally. These spray systems are not considered a limiting factor to surface dispersant operations; the quantity of equipment available through contractual arrangements and the positioning of equipment in first-strike locations is considered adequate for the scale of worst-case surface dispersant operations identified in Section 13.3 and Section 13.4. The timely mobilisation of suitable vessels and personnel required for surface dispersant operations are considered to be the key constraints for this strategy. Santos has defined the specifications for dispersant spray vessels and applies this when tracking potential vessels. A review of control measures associated with personnel identified that improvement could be made by having Santos personnel trained and located in Darwin. Aerial based dispersant application is available to Santos through national and international resources via contractual arrangements. Mobilisation times for these resources are considered to be in line with industry best practice. No potential control measures were identified that could improve mobilisation times for aerial dispersant application. Dispersant volumes available within Darwin and Australia and the mobilisation of these stocks exceed worse case requirements, hence dispersant stock is not a limiting factor to aerial dispersant operations. Seven potential additional/alternative control measures were identified and assessed. One additional control measure was accepted as reasonably practicable: • Santos personnel trained to IMO Level 1 and located in Darwin. Santos Darwin trained personnel mobilised to deployment port location within 24 hours. Six additional / alternative control measures were rejected as grossly disproportionate to the potential reduction in environmental risk. Rejected control measures were: • Santos-owned dispersant spray equipment and dispersant stock located on in-field vessels (boat-spray system and dispersant). • Santos-owned vessel-based dispersant spray equipment and dispersant stock located in Darwin (boat-spray system and dispersant). • Access to additional vessels by contracting vessels to remain on standby for chemical dispersion • Santos to contract personnel from Darwin to deploy and operate vessel spray systems • Access to aircraft via additional service provider • Access to additional dispersant stockpiles owned by Santos Performance Standards and Measurement Criteria that have been developed for the in effect and accepted control measures are shown in Table 13-10.
Containment and Recovery
Santos, AMOSC and AMSA containment and recovery equipment is available which includes offshore rated boom and skimmers suitable for application in response to a potential HFO spill. Containment and recovery equipment availability is not considered a limiting factor to containment and recovery operations; the quantity of equipment available to Santos through contractual arrangements and the positioning of equipment in first-strike locations is considered adequate for the scale of worst-case containment and recovery operations identified in the OPEP. The timely mobilisation of suitable vessels and personnel required for containment and recovery operations are considered to be the key constraints for this strategy. A review of control measures associated with personnel identified that improvement could be made by having Santos personnel trained and located in Darwin.. Six potential additional / alternative control measures were identified and assessed.

ALARP assessment summary
One additional control measure was accepted as reasonably practicable: • Santos personnel trained to IMO Level 1 and located in Darwin. Santos Darwin trained personnel mobilised to deployment port location within 24 hours. Five additional / alternative control measures were rejected as grossly disproportionate to the potential reduction in risk. Rejected control measures were: • Pre-deployed boom positioned around vessel during offtakes • Harbo T-Fence boom (cassette-type boom with magnetic end attachments) to be located on FPSO or support vessels for rapid deployment in the event of a spill • Santos-owned containment and recovery equipment located in Darwin (Offshore boom system and skimmer) • Access to additional vessels by contracting vessels to remain on standby for containment and recovery • Contract for staff from an alternative oil spill personnel provider Performance Standards and Measurement Criteria that have been developed for the in effect and accepted control measures are shown in Table 11-6.
Mechanical dispersion
Mechanical dispersion is a secondary strategy that could be undertaken by vessels undertaking primary response strategies without the requirement for additional equipment, and no areas of improvement were identified. The use of mechanical dispersion in a response would be assessed as part of an operational NEBA. No potential additional control measures were identified and assessed. Performance standards and measurement criteria that have been developed for the in-effect control measures are shown in Table 12-4.
Shoreline protection and deflection
Various types of nearshore booms and skimmers from Darwin and Broome ensures that protection/deflection operations can be deployed to PPAs within 60–72 hours (weather/daylight dependent) in a wide range of metocean conditions. Trained regional Santos personnel can be quickly mobilised to appropriate locations using helicopter services, followed by AMOSC staff and AMOSC Core Group from Perth. These regional and state resources ensure that equipment and personnel are not a limiting factor in this response strategy. Four potential additional / improved control measures were identified and assessed. Two additional / improved control measures were accepted as reasonably practicable. • Santos personnel trained to IMO Level 1 and located in Darwin. • Development of an additional TRP for the Tiwi Islands. Two additional control measures were rejected as grossly disproportionate to the potential reduction in environmental risk. Rejected control measures were: • Santos to purchase additional shoreline and nearshore booms and ancillary equipment • Access to additional shallow draft boom tow vessels owned by Santos Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted control measures are shown in Table 14-6.
Shoreline clean-up
Darwin stockpiles and locally available supplies provide a range of shoreline clean-up equipment that can be accessed to suit most beach types / required clean-up operations. Additional equipment can be transported to Darwin via road or air from other Australian stockpile locations. Trained Santos personnel can be quickly mobilised to appropriate locations using helo. services or vessels, followed by AMOSC staff and AMOSC Core Group. Equipment and trained personnel are not expected to be limiting factors for this response strategy. Waste management may be a limiting factor for ongoing shoreline clean-up operations and further information is shown in the ALARP assessment for Waste Management. Eight potential additional/improved control measures were identified and assessed. Two additional/improved control measures were accepted as reasonably practicable. The accepted control measures were: • Access to additional team leaders that are locally based at strategic locations (Darwin) and trained to IMO Level 1 • Development of an additional TRP for the Tiwi Islands. Six additional/improved control measures were identified, evaluated, and rejected as grossly disproportionate to the potential reduction in environmental risk. Rejected control measures were: • Mechanical mobile plant equipment for clean-up pre-purchased and positioned at strategic locations (Darwin) • Prepurchase and storage of equipment (decontamination/ staging equipment, clean-up and flushing, PPE) at strategic locations (Darwin) • Access to additional shallow draft vessels owned by Santos WA to transport personnel to key sensitive areas on offshore islands

ALARP assessment summary
• Faster access to clean-up personnel via Darwin-/Perth-based labour hire contractor • Faster access to clean-up personnel via locally based labour hire companies or emergency response organisations • Faster access to clean-up personnel via Santos employment of local personnel Performance Standards and Measurement Criteria that have been developed for the in effect and accepted control measures are shown in Table 15-7.
Oiled wildlife
The earliest shoreline contact for all worst-case scenarios associated with the activity is 79 hours (3 days) at Tiwi Islands from the surface release of MDO from a vessel spill scenario (500 m^3 released over 1 hour). Oiled wildlife equipment including first-strike kits and containers can be mobilised to Darwin within 2–7 days. Further equipment is available through national or international resources to implement a timely and sustained response adequate for the scale of worst-case oiled wildlife operations identified in the OPEP. Potential control measures around additional responders through pre-hiring or contracts with additional service providers were investigated but were found to be not beneficial and/or the cost was grossly disproportionate to risk reduction. An additional area of improvement is clarity for how Santos will integrate with Control Agencies OWR. It has been identified that additional planning captured in the Santos Oiled Wildlife Response Framework is a practicable control measure to ensure that resources are deployed in a coordinated approach. Two potential additional/alternative control measures were identified and assessed. No additional/alternative control measures were accepted as reasonably practicable. Two Control Measures were identified but were rejected as grossly disproportionate to the potential reduction in environmental risk. Rejected control measures were: • Pre-hire and/or prepositioning of staging areas and responders • Direct contracts with service providers. Performance Standards and Measurement Criteria that have been developed for the in-effect control measures are shown in Table 16-6.
Waste
The Santos contract with a waste service provider has provisions for waste management operations of the scale estimated to be required in worst-case scenarios detailed in the OSCP. Further detail is captured in Santos' Oil Pollution Waste Management Plan (BAA-201_0027). The waste service provider can mobilise waste receptacles to Darwin within 12–24 hours. Given the waste service provider arrangements and planning already undertaken, waste storage facilities, road transport and logistics are not expected to be limiting factors in the response. An area of improvement was identified regarding the availability of vessels required for waste transport at sea. Two potential control measures to address this area of improvement were identified and evaluated, one of which was accepted and the other rejected due to the cost being grossly disproportionate to the potential reduction in environmental risk. Four additional control measures were identified and assessed. One additional control measure was accepted as reasonably practicable: • Monitoring and hire of additional vessels located in the region, tracked via the Vessel Monitoring System (IHS Maritime Portal). Vessels contracted at the time of incident Three potential control measures were rejected as grossly disproportionate. Rejected control measures were: • Maintain contracts with multiple service providers • Procure temporary waste storage for Santos stockpile • Contract additional vessels on standby for waste transport. Performance Standards and Measurement Criteria that have been developed for the in-effect control measures are shown in Table 17-4.
Operational and scientific monitoring (OSM)
Oil spill OSM will be conducted on behalf of Santos by a contracted OSM services provider via the OSRL OSM Services Supplementary Agreement as detailed in the Santos Northern Australia OSM-BIP (7715-650-ERP-0003) and the relevant Joint Industry Operational and Scientific Monitoring Plans (OMPs/SMPs). An area of improvement identified was the availability of vessels in the initial stages of response. To address this area of improvement, a potential control measure around determining the required vessel specifications to aid with improved vessel tracking was assessed and accepted. An additional control measure for sampling kits to be positioned at Darwin was also accepted. Three other additional potential control measures were identified, but all were rejected due to the cost being grossly disproportionate in comparison to the reduction in risk. A total of five potential additional/alternative control measures were identified and assessed. Two additional/improved control measures were accepted as reasonably practicable: • Purchase of oil sample kits for OSM personnel to be positioned at Darwin • Determine required vessel specifications for OSM implementation to aid with improved vessel tracking through the Vessel Tracking System (IHS Maritime Portal).

ALARP assessment summary
Three additional control measures were rejected as grossly disproportionate. The rejected control measures were: • Scientific monitoring personnel, plant and equipment on standby in Darwin • Trained monitoring specialists on standby at site • Ensure trained marine mammal/fauna observers based at strategic locations such as Darwin Performance Standards and Measurement criteria that have been developed for the in effect and accepted control measures are shown in Table 18-2. The key areas of effectiveness for the identified control measures, during times of preparedness, relate to maintaining access to equipment and personnel through contractual arrangements, regular reviews of OSM Services Provider capability and reviews of existing baseline data. During response, a key area for effectiveness is the mobilisation of requirements to commence OSM and ensuring that relevant OSM plans are followed.

ALARP assessment worksheet

ALARP Assessment							
Source Control (Relief Well Drilling)	Santos Drilling and Completions Source Control Team mobilised within 24 hours. Well Control Specialists mobilised within 72 hours. Contract / MOUs for source control personnel. APPEA MoU for mutual assistance for relief well drilling.	In effect	People	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts. Limit/prevent hydrocarbon contacting sensitive receptors	This primary source control measure provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with maintenance of contracts / MOUs	**In effect**
	Contract source control personnel through an alternative provider in addition to existing arrangements	Additional	People	No environmental benefit if additional services are surplus to requirements	Improved availability and reliability	**Not Feasible** Significant additional cost in maintaining two contracts for the same service	**Reject** - No environmental benefit in having access to personnel surplus to requirements
	Wild Well Control on standby in Perth during drilling operations in order to respond immediately to a well leak	Additional	People	No environmental benefit as WWCI personnel are available to provide support within 72 hours which will coincide with starting to commence sourcing of relief well MODU	No change to effectiveness or reliability as WWC personnel available within a rapid timeframe under existing arrangements.	**Not Feasible** Significant additional costs in having WWC personnel on standby in Perth. Locating personnel with specialised expertise in Perth may also create issues for other operators, as WWC offer thi service to multiple operators. Positioning them in remote locations may increase travel times to other global locations if they are required	**Reject** - No environmental benefit in having access to personnel surplus to requirements
	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a set process to follow in the planning and mobilisation for relief well drilling by Santos Source Control Team thereby reducing the timeframe and increasing the effectiveness of relief well drilling.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with maintaining document	**In effect**
	Regular monitoring of MODU Availability Register to ensure preferred MODU remains available throughout the activity	In effect	Procedure	Monitoring the Availability Register will ensure Santos are aware of any changes in availability of suitable MODUs, enabling Santos to update the Source Control Plan and identify an alternative suitable MODU in the event one changes location.	Provides availability, reliability, compatibility and independence	**Feasible** Cost associated with monitoring MODU availability	**In effect**
	Direct Surface Intervention Via Well Control Experts	Improved	Procedure	Reduce time taken to control source and reduce environmental impacts	- Effectiveness of intervention of this type needs to be assessed at the time given that personnel safety considerations may preclude this control measure. - Mobilisation procedure for personnel as per Source Control Planning and Response Guideline (DR-00-OZ-20001) - Contracts and MoUs for well control personnel (WWC)	**Feasible** Ability to implement and effectiveness of this control can only be determined at the time of an incident.	**Accept** - Santos has a standing agreement with Wild Well Control for call-out of well control experts. - Arrangements already in place to access resources (Source Control Planning and Response Guideline (DR-00-OZ-20001), Contracts) but this control will be applied opportunistically and will be dependent upon safety constraints.
	Pre purchase of relief well drilling supplies	Improved	Equipment	Relief well drilling supplies readily available in Australia, such as casings and well head equipment, could potentially reduce relief well drilling times	Improved availability	**Feasible** Cost of purchase, maintenance and storage of supplies	**Accept** - Offshore D&C commit to having long lead equipment for a relief well at Santos disposal as part of Santos WOMP commitments for each well drilled.
Source Control (vessel collision spill control)	Vessel Spill Response Plan (SOPEP/SMPEP)	In effect	Procedure	Provides a set process to follow in the planning and mobilisation for spill response actions by the Vessel Contractor thereby reducing the timeframe and increasing the effectiveness of spill response.	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Feasible** Cost associated with due diligence checks on contractor procedure.	**In effect**
Source Control (Refuelling / Cargo loading / FPSO topside equipment failure / Subsea flowline rupture spill control)	Facility Incident Response Plan (IRP)	In effect	Procedure	Provides a set process to follow in the planning and mobilisation for spill response actions by the Barossa FPSO facilities, thereby reducing the timeframe and increasing the effectiveness of spill response.	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Feasible** Cost associated with due diligence checks on contractor procedure.	**In effect**

ALARP Assessment							
Oil Spill Trajectory Modelling	Maintain contract with Oil Spill Trajectory Modelling service provider. The service provider will be contacted immediately (within 2 hours) upon notification of a level 2 or 3 spill. Upon activation, the service provider will provide trajectory models within: - 2 hours for OILMAP model for offshore and open ocean; - 4 hours for OILMAP operations for near-shore; and - Detailed modelling service is available for the duration of the incident.	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of contract	**In effect**
	Access to additional spill modelling capability through OSRL	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	An additional service provider ensures redundancy (independence) if for some reason the other service provider was unable to fulfil the function. There is also the possibility of increased functionality associated with improved certainty of the modelling results if both service providers are activated.	**Feasible** Cost of membership	**In effect**
	Purchase of oil spill modelling system and internal personnel trained to use system	Alternative	System / People	This could result in the faster generation of the initial model which may result in an environmental benefit as a consequence of the IMT making operational decisions quicker	Potentially increases availability Decrease in functionality; in house service may not be across technical advances to same extent as contracted service providers	**Feasible** Purchase of system, training of personnel, and on-call roster	**Reject** The cost of purchasing the system, training and having personnel on-call is disproportionate to any potential gains from potentially being able to deliver initial results quicker than the 2 hour turn-around currently guaranteed by the service provider
Tracking Buoy	Level 1: Two tracking buoys located on the FPSO ready for deployment 24/7. Tracking buoys deployed within 2 hrs.	Additional	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of equipment	**Accept**
	Level 2: Two tracking buoys available in Darwin during activity. Tracking buoys deployed within 24 hrs (pending vessel availability).	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of equipment	**In effect**
	Level 2/3: Eight tracking buoys mobilised from Varanus Island, Dampier Supply Base or Exmouth Freight and Logistics. Mobilisation timeframe- 48-72 hrs	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	"Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified"	Cost of equipment	**In effect**
	Level 2: Tracking buoys available from AMOSC and through AMOSC Mutual Aid. Equipment logistics varies according to stockpile location - Mobilisation timeframe estimated 48-72 hrs.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership	**In effect**
	Level 3: Tracking buoys available from OSRL. Transit times (air) Singapore to Darwin = 3–5 days.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership	**In effect**
	Santos purchase additional satellite tracking buoys	Additional	Equipment	There is no expected environmental benefit from having additional tracking buoys, as there are already tracking buoys located on the FPSO ready for deployment 24/7 and any additional needs can be provided by Santos owned stocks. Additional buoys can be accessed from AMSA, AMOSC and OSRL within days with no additional upfront cost.	Increase in availability and reliability	**Feasible** Cost of purchasing additional tracking buoys	**Reject** Does not provide any additional environmental benefit and the cost associated is therefore not warranted

Aerial Surveillance (aircraft and crew)	Maintain contract with service provider for dedicated aerial platform operating out of Darwin. Helicopter services available through Santos' primary contracted supplier. Activation of aerial surveillance using helicopter pilots will occur in 3 hours of notification of the spill. Helicopter on site for surveillance within 10 hrs (daylight hours only). Surveillance and recording using helicopter pilots is considered adequate for situational awareness.	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of contract	**In effect**
Aerial Surveillance (observers)	Level 1: Trained Santos observer will be available within 24 hours, following activation	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of training and maintaining trained staff	**In effect**
	Level 2: Access to additional aerial observers through AMOSC Staff and Industry Mutual Aid Core Group Responders	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of AMOSC membership	**In effect**
	Level 3 : Access to additional aerial observers through OSRL (18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of OSRL membership	**In effect**
	Ensure trained aerial observers based at strategic locations such as Darwin	Additional	People	Current capability meets need and therefore environmental benefit would be incremental. Having trained observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1 (current arrangements are that the pilot would provide the initial observations and recording on Day 1 with trained aerial observers from Perth and VI mobilised and operational by Day 2).	Improved availability and reliability	**Feasible** Costs associated with staff employment and training	**Reject** Cost is considered disproportionate to the incremental benefit given surveillance on Day 2 by pilots is considered sufficient
Aerial Surveillance (unmanned aerial vehicles)	Level 2: Unmanned Aerial Vehicles for aerial surveillance available through AMOSC. UAVs and pilots can be accessed through AMOSC. Equipment mobilisation times vary according to stockpile location - mobilisation time estimated <48 hours)	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given their ability to assess more difficult areas.	Provides functionality and availability Area of improvement; none identified	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3: Unmanned Aerial Vehicles for aerial surveillance available through OSRL	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given their ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	**Feasible** Cost of membership with OSRL	**In effect**
Vessel Surveillance	Vessels and aircraft compliant with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	In effect	Procedure	Provides the procedure for interaction and sighting of protected marine fauna from vessel or aircraft to ensure compliance with EPBC Regulations.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of maintaining and implementing procedure	**In effect**
	Level 1: Vessels already on hire and in use in NT and located at (or in transit to) Darwin or the Barossa Field could be used for surveillance purposes in the event of a spill. Vessel surveillance will be activated within 90 minutes for available on-site vessels. Santos has access to on-hire vessels supporting Barossa facilities. Vessel Monitoring System (IHS Maritime Portal) has access to automatic identification system live-vessel tracking portal to establish vessel availability. Vessel of opportunity on site for surveillance within 48 hours (daylight dependent).	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provides limited information.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of existing contracts with vessel providers	**In effect**

	Level 2: Monitoring and hire of additional vessels located in the region, tracked via the Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**In effect**
	Level 3: Vessels sourced without existing contracts from any location	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	The two vessels that are in use by Santos servicing the Bayu-Undan operations could be used for surveillance purposes in response to a spill.	Additional	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability	Cost of existing contract with vessel contractors.	**Rejected** One vessel is required to be on station at the Bayu-Undan facilities at all times. The second vessel performs critical in-field activities such as methanol bunkering and assisting with off take tanker activities. Therefore, neither vessel could be considered to be reliably available to undertake vessel surveillance activities.
Satellite Imagery	Maintain membership with AMOSC to enable access and analysis of satellite imagery	In effect	Systems	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with AMOSC	**In effect**
	Maintain membership with OSRL to enable access to and analysis of satellite imagery	In effect	System	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with OSRL	**In effect**

ALARP Assessment							
Containment and recovery - booms, ancillary equipment	Level 1: Pre-deployed boom positioned around vessel during offtakes	Additional	Equipment	Pre-deployed boom could limit the spread of hydrocarbons if a spill occurred during the offtake process.	Effectiveness of pre-deloyed boom would be dependent upon suitable metocean conditions, as even offshore booms can be ineffective in containining hydrocarbons in high sea states.	**Not Feasible** Deploying offshore boom around a large vessel situated offshore is very difficult, and requires a very large length of boom (estimated 1,200 m - 1,400 m required to boom around an FPSO type vessel); the recommended maximum joined length for Ro-Boom 1500 Offshore is 600 metres (3 x 200m sections). Boom sections could be deployed and anchored in over-lapping spurs, however anchoring boom at the Barossa field would not be feasible due to the water depths (200-370m). Deploying offshore boom around the FPSO during offtake is therefore not technically feasible. In addition, the process of attempting to deploy the boom may increases the risk of a vessel collision, due to the increased number of vessels required to deploy and maintain the boom. There is also a risk of tangling the boom and anchors in the vessel moorings and load-out line. There are also health and safety risks to personnel in deploying and retrieving the boom. The cost of relocating equipment from Darwin to the Barossa Field for each offtake, together with the costs of attempting to deploy, set and maintaining the booms is disproportionate to the potential reduction in spill risk.	**Reject** Rejected on the basis of technical feasibility, as well as health and safety risks, and cost of attempting to pre-deploy boom prior to each offtake greatly outweighing the potential reduction in risk.
	Level 1: Harbo T-Fence boom (cassette-type boom with magnetic end attachments) to be located on FPSO or support vessels for rapid deployment in the event of a spill	Additional	Equipment	Rapid deployment of containment boom, limiting spread of hydrocarbons	Highly dependent upon metocean conditions	**Not Feasible** This type of boom is designed for inshore use. Therefore, these booms may only be effective offshore in very calm conditions, which is unlikely in the vicinity of the Barossa field. Deploying this type of boom is therefore not technically feasible in this offshore location. In addition, there are cost implications of purchasing and maintaining the booms, stroage and maintenance requirements, and cost of training on-site personnel to deploy it in the event of a spill, all of which are considered grossly disproportionate to the potential reduction in risk due to the technical feasibility constraints.	**Reject** Rejected on the basis of technical feasibility, as well as costs of storage, maintenance and personnel training greatly outweighing the potential reduction in risk**.**
	Level 2: Santos owned containment and recovery equipment located in Darwin (Offshore boom system and skimmer).	Additional	Equipment	Greater capacity for containment and recovery in the initial 2-5 days of response	Improved availability and reliability	**Not Feasible** Although having such a Santos-owned system located in Darwin may reduce the mobilisation time of containment and recovery equipment to the Barossa field, the cost of the equipment and the ongoing training and maintenance requirements and costs are considered grossly disproportionate to the potential reduction in environmental risk. Existing arrangements (AMSA equipment located in Darwin) can have containment and recovery equipment mobilised to the FOB (Darwin Port) within 24 hours.	**Reject** Costs considered grossly disproportionate in relation to the potential reduction in environmental risk; only minimal potential improvement in response time.

	Level 2: AMSA Offshore containment and recovery boom and oil skimmers mobilised from Darwin (refer to OPEP Table 11-4 for equipment lists). Industry Mutual aid boom and skimmer equipment mobilised from Darwin.	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides functionality, availability, reliability, survivability, compatibility and independence. Functionality is attained through access to various equipment types that may be used according to nature of hydrocarbon and metocean conditions. Reliability is attained through AMSA National Plan. Area of improvement; none identified.	**Feasible** Access to National Plan Resources through AMSA. Costs of membership with AMOSC to access mutual aid equipment	**In effect**
	Level 2/3: AMOSC Offshore containment and recovery boom and heavy oil skimmers mobilised from other locations including: - Fremantle - Exmouth - Geelong	In effect	Equipment	Potentially reducing the volume of surface hydrocarbons to reduce contact with protection priorities. Greater capacity for containment and recovery operations. Potentially increased volume of oil collected.	Provides functionality, availability, reliability, survivability, compatibility and independence. Functionality is attained through access to various equipment types that may be used according to nature of hydrocarbon and metocean conditions. Reliability is attained through OSRO membership contracts. Area of improvement: none identified.	**Feasible** Cost of membership with AMOSC.	**In effect**
	Level 2/3: AMSA Offshore containment and recovery equipment mobilised from Karratha and Fremantle (refer to OPEP Table 11-4 for equipment lists).	In effect	Equipment	Potentially reducing the volume of surface hydrocarbons to reduce contact with protection priorities. Greater capacity for containment and recovery operations. Potentially increased volume of oil collected.	Provides functionality, availability, reliability, survivability, compatibility and independence. Functionality is attained through access to various equipment types that may be used according to nature of hydrocarbon and metocean conditions. reliability is attained through maintenance contracts. Area of improvement; none identified.	**Feasible** Access to National Plan Resources through AMSA. Costs of membership with AMOSC to access mutual aid equipment	**In effect**
Containment and recovery - liquid oil waste tanks	Level 2: Liquid waste storage capacity available to support temporary waste storage on board deployment vessels for containment and recovery units. Supplied through a combination of AMOSC, AMSA and contract with Santos contracted container provider. Mobilisation within 24 hrs (based in Darwin)	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides functionality, availability, reliability, survivability, compatibility and independence. Reliability is attained through OSRO membership contracts and terms of engagement conditions with OEG. Area of improvement; increasing the functionality of liquid waste storage tanks through decanting operations approved by AMSA or NT.	**Feasible** Cost of contract with OEG, cost of OSRO membership contracts, MOUs in place for AMOSC, access to National Plan Resources through AMSA.	**In effect**
Containment and recovery- vessels	Level 1/2: Vessels in use by Santos and located at (or in transit to) Barossa Field. Suitable towing/deployment vessels mobilised to deployment port within 24 hrs.	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement: none identified.	**Feasible** Cost of variation to existing contracts with vessel providers.	**In effect**
	Level 2/3: Vessels sourced through Master Service Agreements, located in region and tracked by Santos Vessel Monitoring System (IHS Maritime Portal).	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription). Cost of contracts at the time of requirement/appointment.	**In effect**
	Level 2/3: Vessels sourced without existing contracts from any location and tracked via the Santos Vessel Monitoring System (IHS Maritime Portal)	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement: none identified	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription), cost of brokers fees. Cost of contracts at the time of requirement/ appointment.	**In effect**
	Access to additional vessels by contracting vessels to remain on standby for containment and recovery	Additional	Equipment	Greater capacity for containment and recovery in the initial 2-5 days of response	Improved availability and reliability	**Not Feasible** Cost of vessel to be on standby when not required for oil spill operations	**Reject** Santos monitors vessel availability through Santos Vessel Monitoring System. Regularly contracted vessels could be supplemented with vessels of opportunity

	Determine required containment and recovery vessel specifications, with the aid of the Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001), and source vessels through Master Service Agreement, located in region, tracked via the IHS Maritime Portal and contracted through a Master Service Agreement.	Improved	System	More accurate vessel tracking may lead to faster mobilisation times, potential for response operations at more locations	Improved availability and reliability.	**Feasible** Cost and effort to gather and input data	**In effect**
Containment and recovery-personnel	Level 2: Santos personnel trained to IMO level 1 and located in Darwin. Santos Darwin trained personnel mobilised to deployment port location within 24 hours	Additional	People	Quicker deployment of trained personnel may reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Provides functionality, availability, reliability, survivability, compatibility and independence. Functionality attained through training and exercises. Area of improvement: availability - rapid mobilisation of personnel.	**Feasible** Costs of employment and training of Santos staff.	**Accept**
	Level 2: Spill responders from Fremantle (AMOSC staff), Perth (AMOSC Core Group). Santos Core Group located in other locations mobilised to deployment port (Darwin) within 24-48 hrs. AMOSC Staff and AMOSC Core Group mobilised to deployment port within 24 hrs.	In effect	People	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Provides functionality, availability, reliability, survivability, compatibility and independence. Functionality attained through training and exercises. Area of improvement: availability - rapid mobilisation of personnel.	**Feasible** Employment and training of Santos staff. Cost of contracts in place for AMOSC	**In effect**
	Level 3: Spill responders from Geelong (AMOSC staff), interstate (AMOSC Core Group; AMSA) and international if needed (OSRL). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement: availability - rapid mobilisation of personnel.	**Feasible** Employment and training of Santos staff. Cost of contracts with AMOSC and OSRL	**In effect**
	Contract for staff from an alternative oil spill personnel provider	Alternative	Personnel	Greater capacity for containment and recovery in the later stages of response	Improved availability and reliability	**Not Feasible** Time and cost of contractual management	**Reject** AMSA, AMOSC and AMOSC Core Group and OSRL have sufficient numbers of personnel with the appropriate skill set

Mechanical Dispersion ALARP worksheet

ALARP Assessment							
Mechanical Dispersion	Use of vessel crews, contract vessels and vessels of opportunity to disperse small areas of amenable hydrocarbon types such as marine diesel.	In effect	People / Equipment	Enhanced dispersion and biodegradation of released hydrocarbons. The potential disadvantage of mechanical dispersion is that it could temporarily increase the concentration of entrained and dissolved oil in the vicinity of submerged shallow water receptors (e.g. corals, seagrass and macroalgae). This is most likely in shallow water of a few metres deep	Provides availability, reliability, survivability, compatibility and independence. Limited functionality as mechanical dispersion is secondary response strategy limited by weather conditions, hydrocarbon type and hydrocarbon volume.	**Feasible** - Cost associated with vessel hire - Safety is a key factor and slicks with potential for high volatile organic compound (VOC) emission are not suitable.	**In effect**
	No alternate, additional or improved control measures identified						N/A

ALARP Assessment

Vessel based surface chemical dispersant application- spray systems	Level 1: Santos owned dispersant spray equipment and dispersant stock located on in-field vessels (boat-spray system and dispersant).	Additional	Equipment	Spray system located in-field could increase chance of applying dispersant during 'window of opportunity' for application on fresh hydrocarbons, in the event of a HFO spill during offtake activities.	Improved mobilisation time and increase in likelihood of application during 'window of opportunity'.	**Not Feasible** The additional costs of purchasing a vessel-based dispersant spray system, storing it either permanently on a vessel offshore or mobilising it to the Barossa Field on a dedicated vessel each time an FPSO offtake activity is schedueled, maintaining the system and dispersant, storing the system and dispersant stock, and the training and exercising of field personnel in its use is considered grossly disproportionate to the potential reduction in environmental risk, given that surface dispersant application is a secondary response strategy for HFO, as it is unlikely that dispersant will be effective on such a heavy product.	**Reject** Costs of a dedicated dispersant spray system located in field considered grossly disproportionate in relation to the potential reduction in environmental risk.
	Level 2: Santos owned vessel-based dispersant spray equipment and dispersant stock located in Darwin (boat-spray system and dispersant).	Additional	Equipment	Greater capacity for vessel-based surface dispersant application in the initial 2-5 days of response	Improved availability and reliability	**Not Feasible** Although having such a Santos-owned system located in Darwin may reduce the mobilisation time of vessel-based surface dispersant application equipment to the Barossa field, the cost of the equipment and the ongoing training and maintenance requirements and costs are considered grossly disproportionate to the potential reduction in environmental risk. Existing arrangements (AMSA and mutual aid equipment/dispersant located in Darwin) can have vessel-based dispersant spray equipment and dispersant stock mobilised to the FOB (Darwin Port) within 24 hours.	**Reject** Existing spray systems could be mobilised from Darwin. Costs of Santos-owned equipment considered grossly disproportionate in relation to the potential reduction in environmental risk; only minimal potential improvement in response time compared to existing capabilities.
	Level 2: Vessel spray systems from Darwin (AMSA, 2*Ayles Fernie; Mutual aid, 2*Afedo), Broome (AMOSC, 2*Afedo) Vessel spray system equipment mobilised to deployment port within 12 hrs. Transit times (vessel): Darwin to Barossa field = ~20 hrs Transit times (road): Broome to Darwin = ~19 hrs	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Access to National Plan Resources through AMSA. Costs of membership with AMOSC to access mutual aid equipment	**In effect**
	Level 2/3: Vessel spray systems from Exmouth (WA, 3*Afedo; AMOSC, 1*Afedo, 1*Vikospray), Dampier/ Karratha (WA, 3*Afedo; AMSA, 2*Ayles Fernie), Fremantle (AMOSC, 5*Afedo, 1*Global) Vessel spray system equipment mobilised to deployment port within 12 hrs. Transit times (vessel): Darwin to Barossa field = ~20 hours Transit times (road): Exmouth to Darwin = ~32 hrs Fremantle to Darwin= ~45 hrs	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Access to National Plan Resources through AMSA. Costs of membership with AMOSC	**In effect**
	Level 3: Vessel spray systems from Geelong (AMOSC, 3*Afedo, 3*Vikospray), Singapore (OSRL, 10*systems, additional systems stored at global stockpiles) Transit time (road/ air) Geelong or Singapore to Darwin = 3–6 days	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Costs of membership with AMOSC, OSRL	**In effect**
Vessel based surface chemical dispersant application- vessels	Level 2: Vessels in use by Santos and located at (or in transit to) Barossa Field. Suitable deployment vessels mobilised to deployment port within 24 hrs.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; vessel availability	**Feasible** Cost of existing contracts with vessel providers	**In effect**

	Level 2: vessels sourced through Master Service Agreement, located in region, and tracked by Vessel Monitoring System (IHS Maritime Portal)	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; vessel availability	**Feasible** Cost of vessel monitoring. Cost of contracts at the time of requirement.	**In effect**
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; vessel availability	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Access to additional vessels by contracting vessels to remain on standby for chemical dispersion	Additional	Equipment	Additional vessels with spray systems could increase encounter rate with fresh hydrocarbons	Improved functionality, availability and reliability	**Not Feasible** Cost of vessel purchase or cost of contract to engage vessel on standby	**Reject** Cost is disproportionate to benefit. Multiple vessels in the region are tracked and could be contracted at short notice.
	Define spray vessel specifications and input this information to improve vessel tracking	In effect	System	More accurate vessel tracking may lead to faster mobilisation times could improve dispersant efficacy.	Improved functionality, availability and reliability	**Feasible** Cost and effort to gather and input data	**In effect**
Vessel based surface chemical dispersant application-personnel	Level 2: Santos personnel trained to IMO level 1 and located in Darwin. Santos Darwin trained personnel mobilised to deployment port location within 24 hours.	Additional	People	Quicker deployment of trained personnel may reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Provides functionality, availability, reliability, survivability, compatibility and independence. Functionality attained through training and exercises. Area of improvement: availability - rapid mobilisation of personnel.	**Feasible**	**Accept**
	Level 2: Spill responders from Fremantle (AMOSC staff), Perth (AMOSC Core Group). Santos Core Group located in other locations mobilised to deployment port (Darwin) within 24 hrs.AMOSC Staff and AMOSC Core Group mobilised to deployment port within 24 hrs.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of employing and training Santos Core Group Costs of membership with AMOSC	**In effect**
	Level 3: Spill responders from Geelong (AMOSC staff), interstate (AMOSC Core Group; AMSA) and international (OSRL). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Costs of membership with OSRL	**In effect**
	Santos to contract personnel from Darwin to deploy and operate vessel spray systems	Additional	People	Improve mobilisation time	Improved availability and reliability. Skills required to mount and operate equipment and perform preliminary checks of dispersant effectiveness could be obtained through basic training.	**Not Feasible** Costs associated with increasing scope of existing contract with Darwin Freight and Logistics. Personnel training.	**Reject** Cost is disproportionate to benefit.
Aerial based surface chemical dispersant application- aircraft	Level 2: Access to Fixed Wing Aerial Dispersant Aircraft equipment and personnel through AMOSC under contract conditions. AMOSC to mobilise Fixed Wing aircraft to nominated airbase within 12 hrs. First FWADC test spray within 48 hrs.	In effect	Equipment, people, system	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement: none identified	**Feasible** Costs of membership with AMOSC	**In effect**
	Level 3: Access to aircraft (C130 or B727) for aerial application system through OSRL. C130 available in Darwin within 24 hrs.	In effect	Equipment, people, system	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement: none identified	**Feasible** Costs of membership with OSRL	**In effect**

	Access to aircraft via additional service provider	Alternative	Equipment, people, system	Increased volume of hydrocarbons treated with chemical dispersant	Improved availability and reliability	**Not Feasible** Cost for contract with additional service provider. Potential challenges in managing safety interactions of two different service providers	**Reject** The current contracts with AMOSC and OSRL meet requirements for aerial based application based on a ramp up to 2 FWADC aircraft from 48 hours followed by additional OSRL aircraft if required, which is considered achievable based on resourcing arrangements.
Aerial based surface chemical dispersant application-personnel	Level 2: Aerial Attack Supervisor sourced by AMOSC. AMOSC to mobilise all FWADC capability personnel to nominated airbase within 48 hours.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Costs of membership with AMOSC and aerial service provider	**In effect**
	Level 3: Pilots, spill specialists sourced through OSRL. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Costs of membership with OSRL	**In effect**
Dispersant stocks	Level 2: Dispersant stocks from Darwin (AMSA, 10 m^3 Slickgone NS, 10 m^3 Slickgone EW); Broome (AMOSC, 14 m^3 Ardrox). Dispersants mobilised to deployment port within 24 hrs.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	**Feasible** Access to National Plan Resources through AMSA.	**In effect**
	Level 2: Dispersant stocks from Exmouth (AMOSC, 75m^3 Slickgone NS); Dampier (AMSA, 10m^3 Slickgone NS, 10m^3 Slickgone EW); Fremantle (AMOSC, 27m^3 Corexit 9500, 258m^3 Slickgone NS; AMSA, 48m^3 Slickgone NS, 52 m^3 Slickgone EW). AMOSC dispersants mobilised to nominated airbase within 24 hrs.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	**Feasible** Costs of memberships with AMOSC and OSRL Access to National Plan Resources through AMSA.	**In effect**
	Level 3: Dispersant stocks from other national stockpile locations (AMOSC, 137m^3) (AMSA, 255m^3). OSRL dispersant stocks available in Singapore and worldwide (50% of SLA = 380m^3 as SLA and 5,000m^3 as a subscriber to the Global Dispersant Stockpile). Transit time (road/ air) Geelong or Singapore to Exmouth or Karratha/Dampier = 3–5 days UK or other OSRL bases to Karratha/Dampier = 7-10 days.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified. Availability exceeds requirements	**Feasible** Costs of memberships with AMOSC and OSRL Access to National Plan Resources through AMSA.	**In effect**
	Access to additional dispersant stockpiles owned by Santos	Additional	Equipment	No additional environmental benefit if surplus to requirements	Improved availability and reliability	**Not Feasible** Additional cost for purchase and maintenance of stockpiles	**Reject** Resource Needs Analysis indicates that dispersant supplies sufficient for worst case oil treatment can be met through Australian stockpiles within required timeframes. International stockpiles also available.

ALARP Assessment							
Protection and Deflection (booms and ancillary equipment)	Level 2: AMSA nearshore boom/skimmer equipment mobilised from Darwin (refer to OPEP Table 14-3 for equipment lists).	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of booms, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Access to National Plan Resources through AMSA.	**In effect**
	Level 2/3: Shoreline and nearshore booms plus ancillary equipment mobilised from : - Santos (Exmouth) - AMOSC (Exmouth; Fremantle; Broome) - AMSA (Karratha; Dampier; Fremantle) (refer to OPEP Table 14-3 for equipment lists). Transit times (road) Fremantle to Darwin = ~45 hrs Broome to Darwin = ~19 hrs Karratha to Darwin = ~26 hrs Protection booming equipment mobilised to FOB location within 24 hrs.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of booms, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Access to National Plan Resources through AMSA.	**In effect**
	Level 3: Shoreline and nearshore booms plus ancillary equipment from Geelong (AMOSC), interstate (AMSA) and Singapore (OSRL). Transit times (road/air) Geelong or Singapore to Darwin = 3–6 days. These resources in place to commence protection and deflection within 3-10 days.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Costs associated with equipment purchase and maintenance Costs of contracts, MOUs Costs associated with staff training	**In effect**
	Santos to purchase additional shoreline and nearshore booms and ancillary equipment	Additional	Equipment	Enable more protection and deflection operations to occur simultaneously to protect more key areas	Improved availability and reliability	**Not Feasible** Costs associated with equipment purchase and maintenance	**Reject** Sufficient quantities of equipment located in the region.
Protection and Deflection (vessels)	Level 2: Shallow draft vessels in use by Santos and located at (or in transit to) Darwin. Boom deployment vessel / remote island transfer vessel mobilised to FOB location / port within 24 hrs.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	**Feasible** Cost of existing contracts with vessel providers	**In effect**
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region, tracked (where possible, if fitted with AIS) via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription)	**In effect**
	Level 3: Shallow draft vessels sourced without existing contracts from any location	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Maintain a list of small vessel providers that could be used for nearshore booming	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of maintaining a list of small vessel providers	**In effect**
	Access to additional shallow draft boom tow vessels owned by Santos	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	**Not Feasible** Costs of vessel purchase and maintenance	**Reject** High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.
Protection and Deflection (personnel)	Level 2: Spill responders from Varanus Island, Devil Creek, Perth (Santos), Fremantle (AMOSC), Perth (AMOSC Core Group). Santos Offshore Core Group mobilised to Darwin within 24 hrs. AMOSC Staff and Industry Core Group mobilised to port location within 24-48 hrs.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Availability - Santos access to helo services ensures that regional personnel can be quickly mobilised to the appropriate location. Area for improvement; none identified	**Feasible** Costs of contracts, MOUs with AMOSC, AMSA Costs associated with staff training	**In effect**
	Level 3: Spill responders from Geelong (AMOSC staff, 12 people), interstate (AMOSC Core Group, up to 84 people; AMSA National Response Team, unspecified) and international (OSRL, 18 people). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Costs of contracts, MOUs with AMOSC, AMSA, OSRL Costs associated with staff training	**In effect**
	Santos personnel trained to IMO level 1 and located in Darwin.	Improved	Personnel	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	Costs of employment and training of Santos staff.	**Accept**

Protection and Deflection (planning)	Development of an additional TRP for the Tiwi Islands	Additional	Procedures	Improved level of response planning to streamline resourcing and logistics and effect a better response	Improved functionality	Cost involved in revision of sensitivity mapping and tactical response plans and preparation of additional tactical response plans	**Accept** Tiwi Islands has a short time to contact <3 days (from the surface release of MDO from a vessel spill scenario [500 m^3 released over 1 hour]), and predicted high shoreline loading (from the surface release of HFO from the offtake tanker [460 m^3 released over 1 hour]). A Tactical response plan will be written for the Tiwi Islands prior to operations commencing.

ALARP Assessment							
Shoreline Clean-up (equipment)	Level 2: Manual clean-up and flushing equipment from: Darwin local hardware outlets Varanus Island (Santos WA, 1*container) Fremantle (AMOSC, 1*shoreline support kit and 1*flushing kit) Decontamination/staging equipment from: Darwin (AMSA; 1 * decon station) Karratha (AMSA; 2*decon stations) Fremantle (AMOSC, 1*decon kit; AMSA, 2* decon stations). Mobile plant from local hire companies. PPE from: Exmouth and Varanus Island (Santos WA, 2*containers) Fremantle (AMOSC, 1*decon kit, 2*gas detectors). Transit times (road) Fremantle to Darwin = ~45 hrs Broome to Darwin = ~19 hrs Karratha to Darwin = ~26 hrs Clean-up equipment mobilised to deployment port location 24-48 hours	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - procurement and mobilisation of equipment	**Feasible** Cost of membership with AMOSC Cost of equipment purchase/ hire and maintenance at the time of incident	**In effect**
	Level 3: Manual clean-up and flushing equipment from: Geelong (AMOSC, 1*shoreline support kit, 2* flushing kit, 1*shoreline impact lance kit) Singapore (OSRL) and national hardware outlets. Decontamination/ staging equipment from: Geelong (AMOSC, 1*decon kit). Mobile plant sourced from national hire companies. PPE from Geelong (AMOSC, 1*container, 4*gas detectors). Transit time (road/ air) Geelong or Singapore to Darwin = 3–6 days	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - procurement and mobilisation of equipment	**Feasible** Cost of membership with AMOSC and OSRL Cost of equipment purchase/ hire and maintenance at the time of incident	**In effect**
	Mechanical mobile plant equipment for clean-up pre-purchased and positioned at strategic locations (Darwin)	Additional	Equipment	Environmental benefits and impacts are dependent on hydrocarbon fate and local ecology. Reduced mobilisation times and improved access would assist, should mobile plant be deemed advantageous.	Improved availability and reliability	**Not Feasible** Costs associated with equipment purchase and maintenance	**Reject** There is a high likelihood that mobile plant equipment is not used due to negative environmental impacts, leaving purchased equipment unutilised and costs disproportionate. Locally available hire plant can be used. Additional plant could be purchased and mobilised from Perth if required.
	Pre-purchase and storage of equipment (decontamination/staging equipment, clean-up and flushing, PPE) at strategic locations (Darwin)	Additional	Equipment	Improve mobilisation time, potential for more response locations	Improved availability and reliability	**Not Feasible** Cost in purchase and maintenance of equipment	**Reject** Equipment for first strike available in Darwin. Additional equipment can be mobilised to Darwin in less than 24 hours.
Shoreline clean-up (vessels)	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region, tracked (where possible, if fitted with AIS) via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**In effect**
	Level 3: Shallow draft vessels sourced without existing contracts from any location	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Access to additional shallow draft vessels owned by Santos WA to transport personnel to key sensitive areas	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	**Not Feasible** Costs of vessel purchase and maintenance	**Reject** High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.

Shoreline Clean-up (personnel)	Level 2: Clean-up team leaders from Varanus Island, Devil Creek, Perth (Santos WA), Fremantle (AMOSC staff), Perth (AMOSC Core Group). Santos Core Group mobilised to Darwin within 24 hrs. AMOSC Staff and Industry Core Group mobilised to FOB within 48 hrs.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	**Feasible** Costs associated with staff training. Costs of membership, MoU with AMOSC, AMSA through NatPlan.	**In effect**
	Level 3: Clean-up team leaders from Geelong (AMOSC staff), interstate (AMOSC Core Group; AMSA) and international (OSRL). Interstate staff available from 2 to 3 days. OSRL available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel	**Feasible** Costs associated with staff training Costs of membership, MoUs with AMOSC, AMSA	**In effect**
	Access to additional team leaders that are locally based at strategic locations (Darwin) and trained to IMO level 1	Improved	People	Improved mobilisation time, potential for more response locations	Improved availability and reliability.	**Feasible** Costs of employment and training of Santos staff.	**Accept**
	Access to clean-up labour personnel (predominantly based in Perth).	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	**Feasible** Costs of labour hire through existing service provider	**In effect**
	Faster access to clean-up personnel via Darwin/Perth based labour hire contractor	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	**Not Feasible** Not feasible to mobilise labour hire personnel in less than 72 hours	**Reject** Would not result in access to clean-up personnel any faster than what can be provided via AMOSC Core Group and mutual aid.
	Faster access to clean-up personnel via locally based labour hire companies or emergency response organisations	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	**Not Feasible** No identified regional labour hire companies	**Reject** Would not result in access to clean-up personnel any faster than what can be provided via AMOSC Core Group and mutual aid.
	Faster access to clean-up personnel via Santos employment of local personnel	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	**Not Feasible** Costs associated with personnel employment and training	**Reject** Cost of permanently employing personnel is grossly disproportionate to benefits of availability in initial phase of response.
Shoreline Clean-up (planning)	Development of an additional TRP~~s~~ for the Tiwi Islands	Additional	Procedures	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation in initial 48 hours of incident	**Feasible** Cost associated with development and maintenance of mapping and Tactical Response Plan~~s~~	**Accept** Tiwi Islands has a short time to contact <3 days (from the surface release of MDO from a vessel spill scenario [500 m^3 released over 1 hour]), and predicted high shoreline loading (from the surface release of HFO from the offtake tanker [460 m^3 released over 1 hour]). A Tactical response plan will be written for the Tiwi Islands prior to operations commencing.
Shoreline Clean-up (response)	Prioritise use of existing roads and tracks	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities, improve response time and efficiency			**In effect**
	Soil profile assessment prior to earthworks	In effect	Procedures	Improved baseline information for shoreline condition			**In effect**
	Pre-cleaning and inspection of equipment (quarantine)	In effect	Procedures	Reduced potential for contaminating environment during response activities			**In effect**
	Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance	In effect	Procedures	Improved capacity to respond appropriately to areas of potential cultural significance			**In effect**
	Select temporary base camps in consultation with Control Agency	In effect	Procedures	Optimise response based on camp location, reduce environmental impact of camps			**In effect**
	Shoreline Response Programme Manager assessment/selection of vehicles appropriate to shoreline conditions	In effect	Procedures	Improved response efficiency			**In effect**
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat.	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities			**In effect**
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities			**In effect**

	Stakeholder consultation	In effect	Procedures				**In effect**

ALARP Assessment							
Oiled Wildlife Response (planning)	Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017); sets the corporate guidance for OWR preparedness and response and defines how Santos will integrate with Control Agencies to provide a coordinated response.	In effect	Procedure	The Santos Oiled Wildlife Response Framework Plan (SO-91-BI-20014) is complementary to the WAOWRP and the WA OWR Manual and facilitates a rapid coordinated response, and the provision of resources by Santos in order to increase the likelihood of success of the OWR.	Improved functionality and reliability	**Feasible** Cost of document development and maintenance	**In effect**
	Implementation of the Northern Territory Oiled Wildlife Response Plan (NTOWRP) and the Western Australian Oiled Wildlife Response Plan (WAOWRP).	In effect	Procedure	Working within the guidelines of the WAOWRP and NTOWRP will ensure a coordinated response and that the expectations of the Control Agency are met with the overall aim to increase the likelihood of success of the OWR (success in terms of wildlife survivorship and rates for release back into the wild)	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Effort and time involved in maintaining OWR implementation plan within OPEP	**In effect**
Oiled Wildlife Response (equipment)	Level 2: OWR kits and containers available from AMSA in Darwin	In effect	Equipment	Timely access to appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3: OWR kits and containers available from AMOSC, AMSA and DoT: Broome, Fremantle, Exmouth, Geelong, Dampier, Devonport and Townsville Mobilisation to Darwin within 2-7 days	In effect	Equipment	Appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3 OWR equipment available from OSRL. Transit times (road/ air) . Singapore to Darwin = 3–5 days from activation.	In effect	Equipment	Appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with OSRL	**In effect**
Oiled Wildlife Response (personnel)	Level 1/2 Santos personnel trained in OWR. OWR trained personnel mobilised to Darwin within 48 hrs.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; ensure personnel are based not just in the Perth Office but also at VI and DC facilities	**Feasible** Cost of training and maintaining training	**In effect**
	Level 2 OWR personnel from AMOSC, AMOSC- activated Wildlife Response contractor and Industry Mutual Aid. Mobilisation of OWR personnel to site will start to occur in 24-48 hours following notification of actual or imminent impact to wildlife.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3 OWR personnel available through OSRL. Technical advice from Sea Alarm which includes 2 Technical Advisors (one that can be mobilised to site and one via remote access). Access to GOWRS Oiled Wildlife Assessment Service which includes 4 wildlife expert personnel to provide an on-teh-groud technical assessment of wildlife response needs.	In effect	People	Access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with OSRL	**In effect**
	Maintain labour hire arrangements for access to untrained personnel. Untrained personnel to receive an induction, on-the-job training and work under the supervision of an experienced supervisor.	In effect	People	During a large scale OWR the ability to access large numbers of personnel through labour hire arrangements is imperative in terms of capability for conducting an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of labour hire at time of incident	**In effect**

	Pre-hire and/or pre-positioning of staging areas and responders.	Additional	System	This may enhance response times and first strike capability and hence improve the likelihood of success of the OWR. Conversely, pre-positioned personnel and staging areas may result in negative impacts to the environment and wildlife. The COP will inform the best response strategies at the time of the spill event.	Improved functionality, availability, reliability and independence.	**Not Feasible** Additional wildlife resources could total $1,500 per operational site per day. This is a guaranteed cost regardless of whether a spill occurs or not.	**Reject** The cost of setting up staging areas and having responders on standby is considered disproportionate to the environmental benefit gained. Further, pre-positioned personnel and staging sites may have negative impacts on the environment and wildlife. The overall OWR capability Santos can access through Santos staff, AMOSC, AMOSC mutual aid, and Santos labour force hire arrangements, are considered adequate, with further advice and international resources available through OSRL.
	Direct contracts with service providers.	Alternative	System	This option duplicates the capability accessed through AMOSC and OSRL and would complete for the same resources without providing a significant environmental benefit	Does not improve effectiveness	**Feasible** Cost of contract	**Reject** This option is not adopted as the existing capability / contractual arrangements meets the need.

ALARP Assessment							
Waste Management	Waste management sourced through contract with Darwin-based waste service provider (WSP). Contract with waste service provider maintained and periodically reviewed. Waste receptacles mobilised to Darwin within 12-24 hrs for containment and recovery, protection and deflection and shoreline clean-up response strategies.	In effect	System	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	**Feasible** Cost of contract	**In effect**
	Maintain contracts with multiple waste service providers	Additional	System	Contract with additional waste service provider will not provide an additional environmental benefit as there are two major service providers in the region and reciprocal arrangements facilitate access to equipment of both.	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Not Feasible** Significant additional cost in maintaining two contracts for the same service	**Reject** No environmental benefit
	Temporary waste storage capacity available through waste service provider, AMOSC, AMSA, OSRL stockpiles	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	**Feasible** Costs of contracts, MOU with waste service provider, AMOSC and OSRL, access to National Plan Resources through AMSA	**In effect**
	Procure temporary waste storage for Santos stockpile	Additional	Equipment	Additional storage available if required. Tanks may be stored in geographic locations that may reduce mobilisation times and allow faster collection and storage of waste. Additional storage may facilitate continuous collection operations to occur.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Additional cost in purchase and maintenance of tanks	**Reject** Purchasing this equipment for Santos stockpile is surplus to Santos requirements as WSP, AMOSC, AMSA and OSRL provides this equipment in strategic locations. Reduced mobilisation time is not an advantage, as waste storage can be mobilised at the same time as collection response strategies, and no waste needs to be stored prior to collection commenced.
	Vessels for waste transport through Santos contracted providers. To minimise vessel decontamination requirements, larger vessel will remain on station whilst smaller vessel will transport waste to Darwin.	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility. Area of improvement; dependence and availability of vessels	**Feasible** Cost of contract with vessel providers	**In effect**
	Monitoring and hire of additional vessels located in the region, tracked via the vessel tracking system (IHS Maritime Portal). Vessels contracted at the time of incident (i.e. no master services agreement already in place).	Additional	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility.	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of requirement.	**Accept**
	Contract additional vessels on standby for waste transport	Additional	Equipment	Reduce delays in transportation of waste, particularly greater capacity for containment and recovery in the initial 2-5 days of response	Provides functionality, availability, reliability, survivability, compatibility and dependence	**Not Feasible** Cost in contracting vessels to remain on standby for incident waste requirements	**Reject** Expense of maintaining vessels on standby that are surplus to day to day requirements is disproportionate to environmental benefit. Santos is accustomed to coordinating logistics for tasks around finite resources. Santos monitors vessel availability through Santos Vessel Tracking System. Regularly contracted vessels could be supplemented with vessels of opportunity.
	Vessel to vessel waste transfer plan developed in line with the waste transfer concept of operations (defined in 7710-650-ERP-0001). Plan gives details of waste storage requirements and procedures. Vessel to vessel waste transfer plan gives details of waste storage requirements and procedures.	In effect	Procedure	Allows effective use of available vessels and minimises vessel decontamination requirements	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Feasible** Cost of documentation development, implementation, maintenance and exercising	**In effect**
	Decanting oily water, by returning treated waste water into a boomed area, to be undertaken subject to necessary approvals from AMSA or NT Control Agency	In effect	System / Procedure	Allows more effective handling, transportation and disposal of concentrated wastes	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Feasible** Effort to obtain and adhere to approvals	**In effect**

ALARP Assessment							
Operational & Scientific Monitoring (OSM services provider and equipment)	Maintenance of contract for operational and scientific monitoring services (OSM) and annual review of OSM Bridging Implementation Plans (BIPs). OSM Service Provider and monitoring equipment mobilised to site 72 hrs from OSM Activation.	In effect	System	This is the main tool for determining the extent, severity and persistence of environmental impacts from an oil spill and allows operators to determine whether their environmental protection outcomes have been met (via scientific monitoring activities). It is used to inform areas requiring rehabilitation. This strategy also evaluates the recovery from the spill.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of contract with Operational and Scientific Monitoring (OSM) Service Provider	**In effect**
	Regular capability reports from OSM Services Provider shows personnel availability and annual reviews of OSM BIPs	In effect	System	This ensures the OSM Services Provider has the capability to undertake scientific monitoring, including, post-spill pre-impact surveys within the EMBA of receptors with deficient baseline data.	Improves functionality, availability and reliability	**Feasible** Cost of contract with OSM Services Provider	**In effect**
	Conduct periodical review of existing baseline data sources across the Santos combined EMBA	In effect	System	This ensures that receptors within the EMBA with deficient baseline data are identified	Improves functionality and provides compatibility	**Feasible** Cost of contract with OSM Services Provider	**In effect**
	Operational and scientific monitoring personnel, plant and equipment on standby in Darwin	Additional	People / Equipment	Improve mobilisation time	Improved availability and reliability	**Not Feasible** Cost would be in excess of $1M annually	**Reject** Cost of control measure is disproportionate to the environmental benefit
	Maintain equipment list and list of suppliers for implementation of operational and scientific Monitoring Plans	In effect	Procedure	Improve response time	Improved functionality, availability and reliability	**Feasible** Cost of contract with OSM Services Provider	**In effect**
	Purchase of oil sample kits for operational and scientific monitoring personnel to be positioned at Darwin	Additional	Equipment	Improve response time	Improved availability and reliability	**Feasible** Cost associated with purchase of equipment and maintenance	**Accept**
Operational & Scientific Monitoring (vessels)	Level 2: Hire of vessels located in the region tracked via the Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement. Santos to mobilise monitoring vessels to deployment location 72 hrs from OSM Activation.	In effect	Equipment	Improve response time	Provides availability and reliability	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**In effect**
	Level 3: Vessels sourced without existing contracts from any location	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Determine required vessel specifications according to the IAP, with the aid of the Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) and source vessels through Master Service Agreement, located in region, tracked via the IHS Maritime Portal and contracted through a Master Service Agreement.	Improved	Procedure	Improve mobilisation time	Increase in availability and reliability	**Feasible** Cost to determine vessel specifications	**Accept**
Operational & Scientific Monitoring (Water Quality Monitoring)	Maintain water quality monitoring services through OSM Supplementary Services contract with OSRL. Water quality monitoring personnel, equipment and vessel deployed to spill site within 72 hours of OSM activation.	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	**Feasible** Cost of contract with OSM Services Provider	**In effect**
	Access to additional water quality monitoring services through AMOSC	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	**Feasible** Cost of AMOSC membership	**In effect**

	Determine required vessel specifications according to the IAP, with the aid of the Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) and source vessels through Master Service Agreement, located in region, tracked via the Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Procedure	Improve mobilisation time	Improved availability and reliability	**Feasible** Cost to determine vessel specifications	**In effect**
	Purchase of first strike oil/water quality monitoring kits to be positioned at Darwin. Technical procedure for sample collection developed (Santos Oil and Water Sampling Procedures - 7710-650-PRO-0008).	In effect	Equipment / Procedure	Will enable oil fingerprinting and initial measurements of oil concentrations	Improve function, availability, survivability and compatibility	**Feasible** Cost of purchasing equipment and developing procedure	**In effect**
	Trained monitoring specialists on standby at site	Additional	People	Ensure sampling is conducted correctly	Improves reliability	**Feasible** Costs associated with staff employment	**Reject** This is not necessary as a procedure for sample collection is in place (Santos Oil and Water Sampling Procedures - 7710-650-PRO-0008)
Operational & Scientific Monitoring (Shoreline Assessment)	Level 2: AMOSC staff and core group operations personnel	In effect	People / Procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of AMOSC membership	**In effect**
	Level 3: Maintain membership with OSRL to access SCAT trained responders (OSRL, 18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/clearances.	In effect	People / Procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts	Provides additional functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of OSRL membership	**In effect**
Operational & Scientific Monitoring (Wildlife Reconnaissance - aerial/vessel surveillance, shoreline and coastal habitat assessment)	Maintain contract with operational and scientific monitoring services provider for access to fauna aerial observers and personnel experienced in conducting relevant fauna surveys through OSM Supplementary Services contract with OSRL.	In effect	People / Procedures	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Provides functionality, availability and compatibility Area for improvement; availability - reduce time to mobilise personnel to strategic locations	**Feasible** Cost of contract	**In effect**
	Maintain a list of providers that could assist with fauna aerial observations, e.g. whale shark spotting planes	In effect	People	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Improves availability and reliability Area of improvement; none identified	**Feasible** Cost of developing and maintaining list	**In effect**
	Ensure trained marine mammal/fauna observers based at strategic locations such as Darwin	Additional	People	Having trained marine mammal/fauna observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1	Improved availability and reliability	**Feasible** Costs associated with staff employment and training	**Reject** Maintaining trained fauna observers at location is considered grossly disproportionate as they are required only for the initial stages of the response until observers from scientific monitoring provider can be mobilised.

Appendix C Pollution report

Harmful Substances Report – oil (POLREP)

Marine Pollution Regulations 2003 s37(4)

This form is to be submitted to the NT Government **and** Australian Maritime Safety Authority:

NT Government

Email to:

- pollution@nt.gov.au and
- marinesafety@nt.gov.au and
- rhm@nt.gov.au

Australian Maritime Safety Authority

General Manager, Response
through Joint Rescue Coordination Centre
(JRCC) Australia

Facsimile: +61 2 6230 6868
AFTN: YSARYCYX

Email: rccaus@amsa.gov.au

Note: sections of the ship reporting form that are not relevant should be omitted from the report. If there is insufficient space on this form, attach additional information.

A. **Name of Ship** | **Call Sign**

Ship's IMO | **Flag State**

Name of Ship's Master | **Ship's Master contact details**

B. **Date and time of event (time must be expressed as Coordinated Universal Time UTC)**

C. **Position: latitude and longitude**

or

D. **Position: true bearing and distance**

E. **True course (as a three digit group)**

F. **Speed (in knots and tenths of a knot as a 3-digit group)**

L. **Route information (details of intended track)**

M. **Full details of radio stations and frequencies being guarded**

N. **Time of next report (time must be expressed as Coordinated Universal Time UTC)**

P. **Types and quantities of cargo and bunkers on board**

Q. **Brief details of defects, damage, deficiencies or other limitations (this must include the condition of the vessel and the ability to transfer cargo, ballast or fuel)**

R. **Brief details of actual pollution (this must include the type of oil, an estimate of the quantity discharged, whether the discharge is continuing, the cause of the discharge and if possible, an estimate of the movement of the slick)**

S. Weather and sea conditions including wind force and direction, and relevant tidal or current details

T. Name, address, telephone and facsimile numbers of the vessel's owner and representative (manager, operator, or their agents)

Owner		**Representative**	
Company IMO		**Company IMO**	
Address		**Address**	
Telephone	**Facsimile**	**Telephone**	**Facsimile**

U. Details of length, breadth, tonnage and type of ship

Type of vessel	**Length**	**Breadth**	**Tonnage**

X. 1. Action being taken with regard to the discharge and movement of the ship

2. Assistance or salvage efforts which have been requested or which have been provided by others

3. The master of an assisting or salvaging vessel should report the particulars of the action undertaken or planned

Appendix D Situation report

Government of **Western Australia**
Department of **Transport**

Maritime Environmental Emergency Situation Report (SITREP)

MEER

When blank, this form is classed as OFFICIAL, when filled out, this form is classed as OFFICIAL-SENSITIVE.

Return completed form to:
Maritime Environmental Emergency Response
Department of Transport
Email: marine.pollution@transport.wa.gov.au and rccaus@amsa.gov.au
Phone (08) 9480 9924

MARITIME ENVIRONMENTAL EMERGENCY SITUATION REPORT (SITREP)

This is advice from the Control Agency of the current status of the incident and the response.
This form is transmitted to all relevant agencies including:

- Jurisdictional Authority
- Support Agencies

INCIDENT DESCRIPTION

Incident Name: ______________________ Ref. No. ______________________

Incident Controller: ______________________

Incident Declaration Level: Please select ______________________ Controlling Agency: Please select ______________________

Priority ☐ Urgent ☐ Immediate ☐ Standard

Final SITREP? ☐ Yes ☐ No

Next SITREP on: ______________________

Date and Time of Incident (24 hr format): ______________________

POLREP or AMSA Form 18 Reference : ______________________

Incident location: ______________________ Latitude: ______________________ Longitude: ______________________

Brief description of incident and impact: ______________________

Overall weather conditions: ______________________

Summary of response actions to date: ______________________

Current Strategies:

Summary of resources available/deployed:

Expected developments:

Other Information:

Maritime Environmental Emergency Situation Report (SITREP)		
Reporter's Signature:		
Name:	**Agency:**	**Role:**

Once you have completed the form please check that all relevant fields have been filled with accurate data.
Please email completed form to marine.pollution@transport.wa.gov.au

Appendix E Vessel surveillance observer log

Vessel Surveillance Observer Log – Oil Spill

Survey Details			
Date	Start time:	End Time:	Observers:
Incident:			Area of Survey:
Vessel:			Master:

Weather Conditions	
Wind speed (knots):	Wind direction:
Time high water and height (LAT):	Current direction:
Time low water and height (LAT):	Current speed (nM):
Tide during observations:	Sea state:
Stage of tide during observations (incoming/falling):	Other weather observations:

Slick Details						
Slick grid parameters by lat/long:		Slick grid parameters (vessel speed)		Slick grid dimensions: N/A		
Length Axis:	Width Axis:	Length Axis: N/A		Width Axis	Length	nm
Start Latitude	Start Latitude	Time (seconds)		Time (seconds)	Width	nm
Start Longitude	Start Longitude				Length	nm
End Latitude	End Latitude	Speed (knots)		Speed (knots)	Width	nm
End Longitude	End Longitude				Grid area	km^2

Code	Colour	%age cover observed	Total grid area		Area per oil code		Factor	Oil volume	
1	Silver			km^2		km^2	40-300 L/ km^2		L
2	Iridescent (rainbow)			km^2		km^2	300-5,000 L/ km^2		L
3	Discontinuous true oil colour (Brown to black)			km^2		km^2	5,000-50,000L/ km^2		L
4	Continuous true oil colour (Brown to black)			km^2		km^2	50,000 – 200,000 L/ km^2		L
5	Brown / orange			km^2		km^2	>200,000 L/ km^2		L

Timeline of observations:

Time	Description

Appendix F Aerial surveillance observer log

Aerial Surveillance Observer Log – Oil Spill

Survey Details				
Date:	Start time:	End Time:	Observer/s:	
Incident:			Area of Survey:	
Aircraft type:	Call sign:		Average Altitude:	Remote sensing used:

Weather Conditions	
Wind speed (knots)	Wind direction
Cloud base (feet)	Visibility
Time high water	Current direction
Time low water	Current speed (nM)

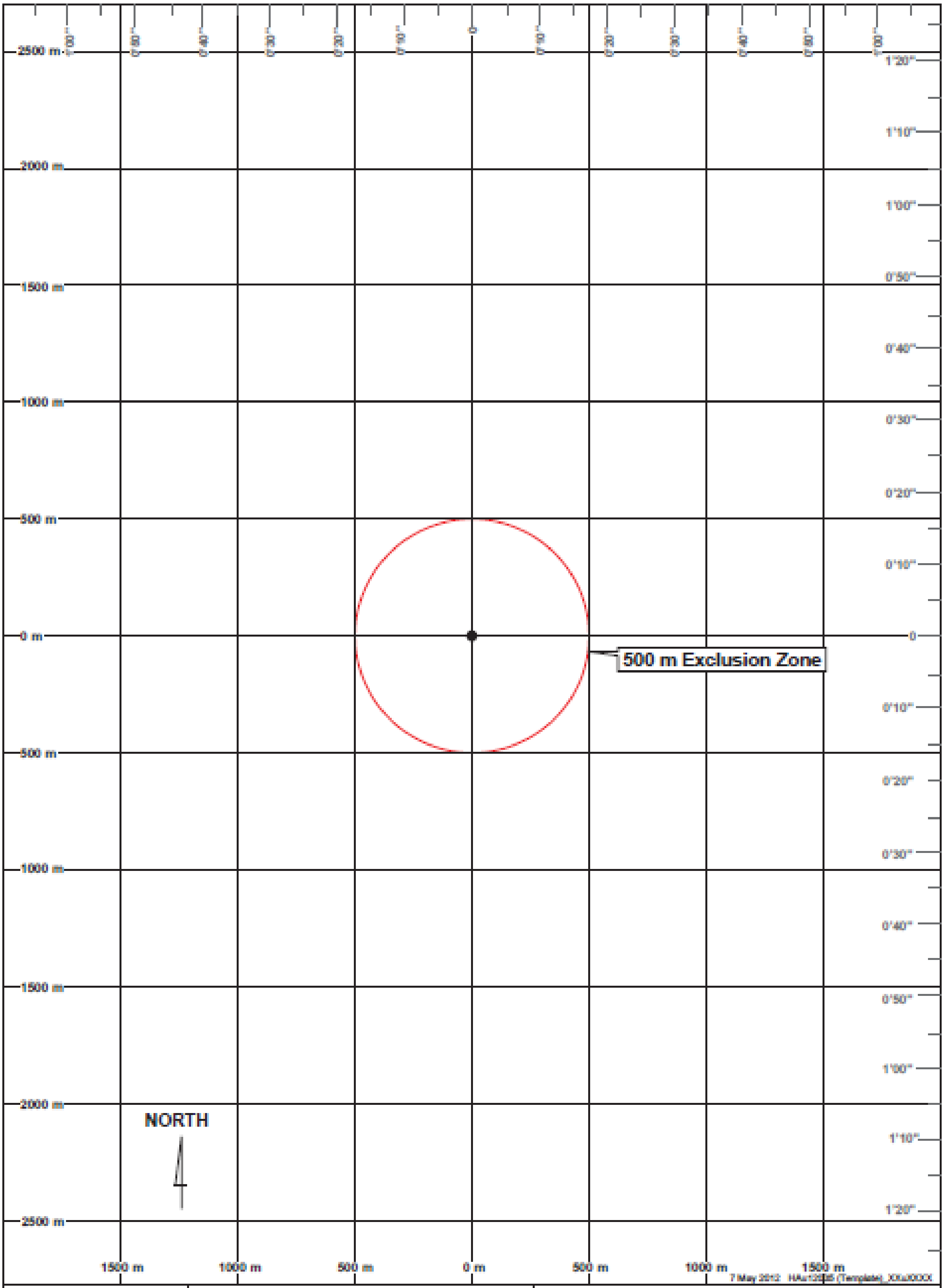
Slick Details						
Slick grid parameters (lat/long)		Slick grid parameters (air speed)		Slick grid dimensions		
Length Axis	Width Axis	Length Axis		Width Axis	Length	nm
Start Latitude	Start Latitude	Time (seconds)		Time (seconds)	Width	nm
Start Longitude	Start Longitude				Length	nm
End Latitude	End Latitude	Air Speed (knots)		Air Speed (knots)	Width	nm
End Longitude	End Longitude				Grid area	km^2

Code	Colour	% cover observed	Total grid area		Area per oil code		Factor	Oil volume	
1	Silver			km^2		km^2	40-300 L/ km^2		L
2	Iridescent (rainbow)			km^2		km^2	300-5,000 L/ km^2		L
3	Discontinuous true oil colour (Brown to black)			km^2		km^2	5,000-50,000L/ km^2		L
4	Continuous true oil colour (Brown to black)			km^2		km^2	50,000 – 200,000 L/ km^2		L
5	Brown / orange			km^2		km^2	>200,000 L/ km^2		L

Appendix G Aerial surveillance surface slick monitoring template

Santos

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



NAME:	VESSEL / AIRCRAFT:
DATE / HOUR:	OTHER REFERENCE:

Santos

Appendix H Aerial surveillance marine fauna sighting record

OIL SPILL SURVIELLANCE - MARINE FAUNA SIGHTING RECORD SHEET

Date:		**Time:**	
Latitude:		**Longitude:**	

MARINE FAUNA ID GUIDE

○ Humpback whale

○ Blue whale

○ Minke whale

○ Sperm whale

○ Killer whale

○ Bryde's whale

○ Whale species unknown

○ Bottlenose dolphin

○ Spinner dolphin

○ Dolphin species unknown

○ Whale shark

○ Dugong

○ Hawksbill turtle

○ Loggerhead turtle

○ Green turtle

○ Flatback turtle

○ Leatherback turtle

○ Turtle species unknown

FAUNA DETAILS					
Category	**Type/species?** **Adult/juvenile?** **ID confidence?**	**Number**	**Date/Time**	**Photo/ video taken?** **Reference No.**	**<u>Behaviour / Comments.</u>** **Proximity to oil? Oiled?** **Milling? Feeding? Transiting?**
Cetaceans (Whales/ Dolphins)					
Turtles					
Birds					
Dugongs					
Sharks					
Other					

Other details for each observation location
WEATHER DETAILS
Sea State ◯ Mirror calm ◯ Small waves ◯ Slight ripples ◯ Large waves some whitecaps ◯ Large waves, many whitecaps
Visibility ◯ Excellent ◯ Good ◯ Moderate ◯ Poor ◯ Very Poor

OBSERVER DETAILS		
<u>Observer Name</u>	<u>Observer signature</u>	**Observer** ◯ Inexperienced ◯ Experienced

Appendix I Aerial surveillance shoreline observation log

Aerial Surveillance Reconnaissance Log – Oil Spill

<table>
<tr><td colspan="6">Survey Details</td></tr>
<tr><td>Incident:</td><td>Date:</td><td>Start time:</td><td>End Time:</td><td colspan="2">Observer/s:</td></tr>
<tr><td colspan="6">Area of Survey</td></tr>
<tr><td colspan="3">Start GPS
LATITUDE:
LONGITUDE:</td><td colspan="3">End GPS
LATITUDE:
LONGITUDE:</td></tr>
<tr><td>Aircraft type</td><td colspan="2">Call sign</td><td colspan="2">Average Altitude</td><td>Remote sensing used (if any)</td></tr>
<tr><td colspan="6">Weather Conditions</td></tr>
<tr><td colspan="2">Sun/Cloud/Rain/Windy</td><td colspan="2">Visibility</td><td colspan="2">Tide Height
L/M/H</td></tr>
<tr><td colspan="2">Time high water</td><td colspan="2">Time low water</td><td colspan="2">Other</td></tr>
<tr><td colspan="6">Shoreline Type - Select only ONE primary (P) and ANY secondary (S) types present</td></tr>
<tr><td></td><td>Rocky Cliffs</td><td></td><td>Boulder and cobble beaches</td><td></td><td>Sheltered tidal flats</td></tr>
<tr><td></td><td>Exposed artificial structures</td><td></td><td>Riprap</td><td></td><td>Mixed sand and gravel beaches</td></tr>
<tr><td></td><td>Inter-tidal platforms</td><td></td><td>Exposed tidal flats</td><td></td><td>Fine-Medium sand grained beaches</td></tr>
<tr><td></td><td>Mangroves</td><td></td><td>Sheltered rocky shores</td><td rowspan="2"></td><td rowspan="2">Other</td></tr>
<tr><td></td><td>Wetlands</td><td></td><td>Sheltered artificial structures</td></tr>
<tr><td colspan="6">Operational Features (tick appropriate box)</td></tr>
<tr><td></td><td>Direct backshore access</td><td></td><td>Alongshore access</td><td></td><td>Suitable backshore staging</td></tr>
<tr><td colspan="6">Other</td></tr>
</table>

Appendix J Shoreline clean-up equipment

Table J-1: Recommended equipment for an initial deployment of a 6-person shoreline clean-up team

Shore clean-up Tools	Quantity
Disposal Bag Labelled, 140 cm x50cm x 100µm	1,000
Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100µm	50
Polyethylene Safety Shovel 247mm z 978mm	2
Steel Shovel	4
Steel Rake	2
Landscapers Rake	2
Barrier Tape – "Caution Spill Area"	10
Pool scoop with extendable handle – flat solid	2
Poly Mop Handle	2
Safety Retractable Blade Knife	2
Poly Rope 20m	6
Star Pickets	24
Star Picket driver	1
Hand Cleaner	1
Cable ties – general use	1,000
Wheel Barrow	2
Galvanised Bucket	4
Pruning secateurs	2
Hedge Shears	1
Personal Protection Equipment (PPE) – Team of 6	
Spill Crew Hazguard water resistant coveralls (assorted sizes)	36
Respirator dust/mist/fume and valve	40
Disposable box light nitrile gloves (100bx)	2
Alpha Tec gloves (assort size)	24
Ear Plugs (200bx)	1
Safety Glasses	18
Safety Goggles non vented	6
Gum Boots (assort size)	18
Rigger Gloves (assort size)	18
Day/Night Vest	6
Storage Equipment	
Collapsible Bund 1.6m x 1.2m	2
Collapsible bund 4m x 2.4m	1
Misc. sizes of ground sheets / tarps.	6
Absorbents	
Absorbent Roll 'oil and fuel only' 40m x 9m	6
Absorbent Pad "oil and fuel only" 45cm x 45cm	400
Poly Mops (snags)	150
Poly Absorbent Wipes	10
Additional Items	
Folding Deck Chair 6	6
Folding Table 1	1
Shelter open side 1	1
6 Person first aid kit 1	1
Wide Brim Hat with cord 6	6
Sunburn Cream 1 litre pump bottle 1	1
Personal Eyewash bottle 500mls 6	6
Personal Drink bottle 750mls 6	6
Boxes, Bin and Lid Storage/transport assorted	-
Optional items	
Inflatable tent 9 square metres	1

Table J-2: Recommended equipment list for a decontamination unit for a shoreline clean-up team

Shore clean-up Tools	Quantity
Inflatable Decon Tent	1
Inflatable Tent 9 square metres – Modesty or Control tent	1
Misc sizes of ground sheets/tarps	4
Collapsible Bund 1.6m x 1.2m (two stages)	2
2 stools in each bund	4
Collapsible Bund 4m x 2.4m (for used PPE and clothing into DB's)	1
Long Handled Scrub brush	2
Scrub Brush	2
Simple Green 20 ltr	2
Poly Absorbent Wipes	10
Wet Wipe Canister	6
Disposal Bag for Clothing, 140cm x 50cm x 100µm	100
Bath towel	6
Liquid soap in push dispenser (citrus based)	1
Track mat – Absorbent for Corridor/walkway	1
Star pickets	16
Star picket driver	1
Barrier tape to create corridors	4
Safety Goggles non vented (used during decon)	6
Additional items	
Folding Deck Chair	6
Folding Table	1
Shelter open side	1
6 Person first aid kit	1
Wide Brim Hat with cord	6
Sunburn Cream 1 litre pump bottle	1
Personal Eyewash bottle 500mls	6
Personal Drink bottle 750mls	6
Boxes, Bin and Lid Storage/transport assorted	-

Table J-3: Recommended equipment list for deployment of a 6-person team for shoreline flushing or recovery

Flushing Equipment	Quantity
Diesel self prime semi trash pump, 25-35 psi, 4.8hp	1
Perforated 2" lay flat hose, 20 m sections	2
Section Hose 2", 20m sections	5
Hose End Strainer	1
Recovery Equipment	
Tidal Boom (shoreline boom) 25m lengths	2 (50m)
Tidal Boom Accessories pack 1	1
Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section 2 (50m)	2 (50m)
Towing Bridle 2	2
Danforth Sand Anchor Kit, 30m lines, 15m trip lines 3	3
Diesel Powered pump with hose 1	1
Manta Ray skimmer 1	1
Personal Protection Equipment (PPE) – Team of 6	
Spill Crew Hazguard water resistant coveralls (assorted sizes)	36
Respirator dust/mist/fume and valve	40
Disposable box light nitrile gloves (100 box)	2
Ear Plugs (200 box)	1
Safety Glasses	18
Gum Boots (assorted sizes)	18
Hyflex Oil Restraint Gloves (assorted sizes)	18
Day/Night Vest	6
Storage Equipment	
Collapsible Bund 1.6m x1.2m	1
Misc sizes of ground sheets/tarps	6
Collapsible Tank 5,000 litres	2
Absorbents	
Absorbent Boom 'oil and fuel only' 3 or 6m x 180,mm	200 m
Absorbent Roll 'oil and fuel only' 40m x 9m	10
Absorbent Pad "oil and fuel only" 45cm x 45cm	1,000
Poly Absorbent Wipes	10
Additional Items	
Folding Deck Chair	6
Folding Table	1
Shelter open side	1
6 Person first aid kit	1
Wide Brim Hat with cord	6
Sunburn Cream 1 litre pump bottle	1
Personal Eyewash bottle 500mls	6
Personal Drink bottle 750mls	6
Boxes, Bin and Lid Storage/transport assorted	-
Inflatable Tent 9 square metres	1

Table J-4: Recommended equipment list for a 6-person team for near shore clean-up

Absorbents	Quantity
Absorbent Roll 'oil and fuel only' 40m x 9m	20
Absorbent Pad "oil and fuel only" 45cm x 45cm	2,000
Absorbent Boom "oil and fuel only" 3or6m z 180mm	200 m
Poly Mops (snags)	150
Poly Absorbent Wipes	20
Recovery Equipment	
Tidal Boom (shoreline boom) 25m lengths	4 (100 m)
Tidal Boom Accessories pack	2
Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section	8 (200 m)
Towing Bridle	2
Danforth Sand Anchor Kit 15kg 30m lines, 15m trip lines	10
Weir Skimmer 30T hr	1
Trash Screen for above	1
Diesel Powered pump with hose	1
Manta Ray skimmer	1
Shore Clean-up Tools	
Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100µm	200
Pool scoop with extendable handle – flat solid	2
Poly Mop Handle	2
Poly Rope 20m	10
Star Pickets	24
Star Picket driver	1
Intrinsic Safe Torch	6
Hand Cleaner	1
Cable ties (to add extra join to absorbent booms)	150
Personal Protective Equipment (PPE) Team of 6	
Spill Crew Hazguard water resistant coveralls (assorted sizes)	36
Disposable box light nitrile gloves (100 box)	2
Alpha Tec gloves (assorted sizes)	24
Ear Plugs (200bx)	1
Safety Glasses – with head strap	18
Gum Boots (worn extra large or as advised by skipper)	18
Steel cap waders	2
Personal Flotation Device	6
Rigger Gloves (assort size)	18
Storage equipment	
Collapsible Bund 1.6 m x 1.2 m	2
Collapsible bund 4 m x 2.4 m	1
Collapsible Tank 5,000 litres	2
Alum box, Bin & lid Storage/transport cases	10
Misc. sizes of ground sheets/tarps	6
Additional Items	
6 Person first aid kit 1	1
Wide Brim Hat with cord 6	6
Sunburn Cream 1 litre pump bottle 1	1
Personal Eyewash bottle 500mls 6	6
Personal Drink bottle 750mls 6	6

Appendix K Shoreline response strategy guidance

Guidance on response methods for sensitive coastal habitats is provided in Table K-1.

Guidance on applicable shoreline clean-up techniques based on shoreline substrate and degree of oiling are presented in Figure K-1 to Figure K-4.

Table K-1: Strategy Guidance for shoreline response at coastal sensitivities

Sensitive receptors	Strategy guidance
Mangroves	• All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. • However, if oil is expected to move into this area, multiple rows of booms, or earthen booms can be deployed at the entrance of creeks or along the mangrove fringe to prevent/minimise oiling. • Sorbents can be used to wipe heavy oil coating from roots in areas of firm substrate. Close supervision of clean-up is required. • Where thick oil accumulations are not being naturally removed, low-pressure flushing may be attempted at the outer fringe – sorbent pads and sorbent sweeps can be used to recover the sheen. • No attempt should be made to clean interior mangroves, except where access to the oil is possible from terrestrial areas. • Oily debris should be removed; it is extremely important to prevent disturbance of the substrate by foot traffic; thus most activities should be conducted from boats. • Live vegetation should not be cut or otherwise removed.
Mudflats	• All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. • However, if oil is expected to move into this area, multiple rows of booms, or earthen booms can be deployed at the entrance of channels filling/ draining mudflats. • Efforts to manually clean mudflats may result in further damage due to trampling of the oil into sediments which typically rich in biota and provide a food source for fish and birds. • Therefore, natural remediation may be the preferred approach and if removal is required, the flushing of oil into open water, if feasible, may be preferred to manual collection • The presence of wildlife (e.g. shorebirds) and sensitive flora (e.g. mangroves) which are often associated with mudflats needs to be considered in determining the best approach.
Sandy beaches	• Clean-up techniques will depend upon the degree of infiltration into sand or and degree of burial which will require surveying/mapping • Clean-up will also depend upon sensitivity of environment (existing ecological features), access to the beach and potential for additional erosion. • Oil and oiled sediments can be physically removed offsite, moved to surf zone for surf washing of sediment or assisted to move to water edge by ploughing of channels or flushing. • Recovery of oil can be by manual means (hand tools) or mechanical means (earth moving, pumping equipment). • The sensitivity of the environment is a key factor, with manual removal creating less waste and disturbance but more consuming in time and resources.
Seabirds, shorebirds and migratory waders	• All efforts should focus on deflecting oil away from this area or dispersing the oil offshore or using booms offshore to divert the oil away from this area. • If oil is expected to move into the coastal colonies and roosting areas, multiple booms can be deployed along the reserve to prevent/minimise oiling.
Turtle nesting beaches during or near nesting season	• All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. • However, if oil is expected to move into this area, booms can be deployed along the reserve to prevent/minimise oiling.
Fringing coral reef communities	• Little can be done to protect coral reef beds along exposed sections of shoreline. • Floating oil would potentially coat living reef communities, which are usually slightly elevated and are consequently exposed at low tide.

Sensitive receptors	Strategy guidance
(Note: submerged coral reef communities are less susceptible to oiling)	• Natural recovery with a close monitoring program is the preferred clean-up technique. Clean-up of the reef itself by natural processes is expected to be rapid. • As much as practicable, oil should be removed from adjacent intertidal areas to prevent chronic exposure of the corals to oil leaching from these sites. • Use of sorbents should be limited to those that can be contained and recovered.
Macroalgal and seagrass beds	• All efforts should focus on deflecting oil away from this area, dispersing the oil offshore, or using booms to divert the oil away from this area. • Extreme care should be taken not to disturb the sediments during clean-up operations in the vicinity of macroalgal and seagrass beds, which could result in total loss of the macroalgal and seagrass beds. • Removal of oiled parts of the macroalgal and seagrass beds should only be considered when it can be demonstrated that special species are at significant risk of injury from contact or grazing on the macroalgal and seagrass beds. • Otherwise, the best strategy for oiled seaweed is to allow natural recovery.
Rocky coast	• Where practicable, booms can be deployed parallel to the rocky coasts to prevent/minimise oiling. • Flushing rocky shoreline is considered the most effective method of cleaning. Care must be taken to assess the fate and transport of the flushed oil and sorbent snares can be used to recover if deemed necessary to reduce impacts to ALARP. • For small areas of contamination, rocky structure can be manually wiped with sorbent pads or scraped to remove oil.

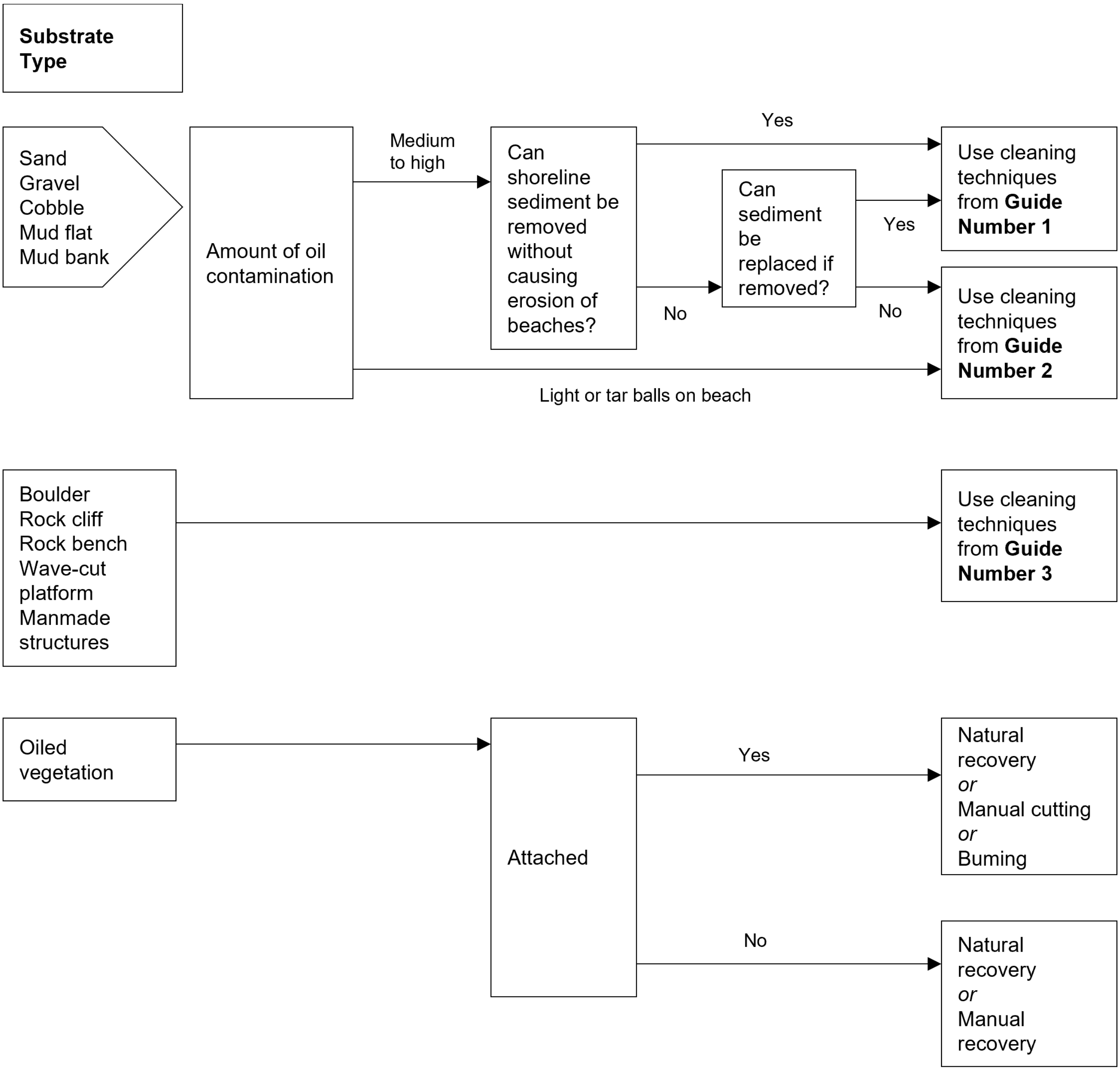


Figure K-1: Shoreline Clean-up Master Decision Guide

Trafficability		Substrate type	Depth of penetration	Clean-up techniques in order of preference	Access	
1. Can rubber-tyred equipment operate on beach?	➔ Yes	Sand, Gravel. Mud	Less than 3 cm	Motor-grader and elevated scraper combination. Elevated Scraper, Motor-grader and Front-end loader (Rubber-tyred) combination.	**3. Is there access to beach for heavy equipment or can access be constructed?**	➔ Yes ↓
			Greater than 3 cm	Elevated Scraper. Front-end loader (Rubber-tyred). Bulldozer and Front-end loader (Rubber-tyred) combination.		Select most preferable technique
		Cobble	Less than 30 cm	Front-end loader (Rubber-tyred).		
			Greater than 30 cm	Bulldozer and Front-end loader (Rubber-tyred) combination. Front-end loader (Rubber-tyred).		
		Mud bank	Not applicable	Backhoe. Front-end loader (Rubber-tyred).		
↓ No						
2. Can tracked equipment operate on beach?	➔ Yes	Sand, Gravel, Mud, Cobble	Less than 30 cm	Front-end loader (Tracked). Bulldozer and Front-end loader (Tracked) combination.		
			Greater than 30 cm	Bulldozer and Front-end loader (Tracked) combination. Front-end loader (Tracked).		
↓ No					↓ No	
Use dragline or hydraulic grader or leave to natural recovery				Go to next Figure – Decision guide No. 2, Question 4.		

Figure K-2: Shoreline Clean-Up Decision Guide 1

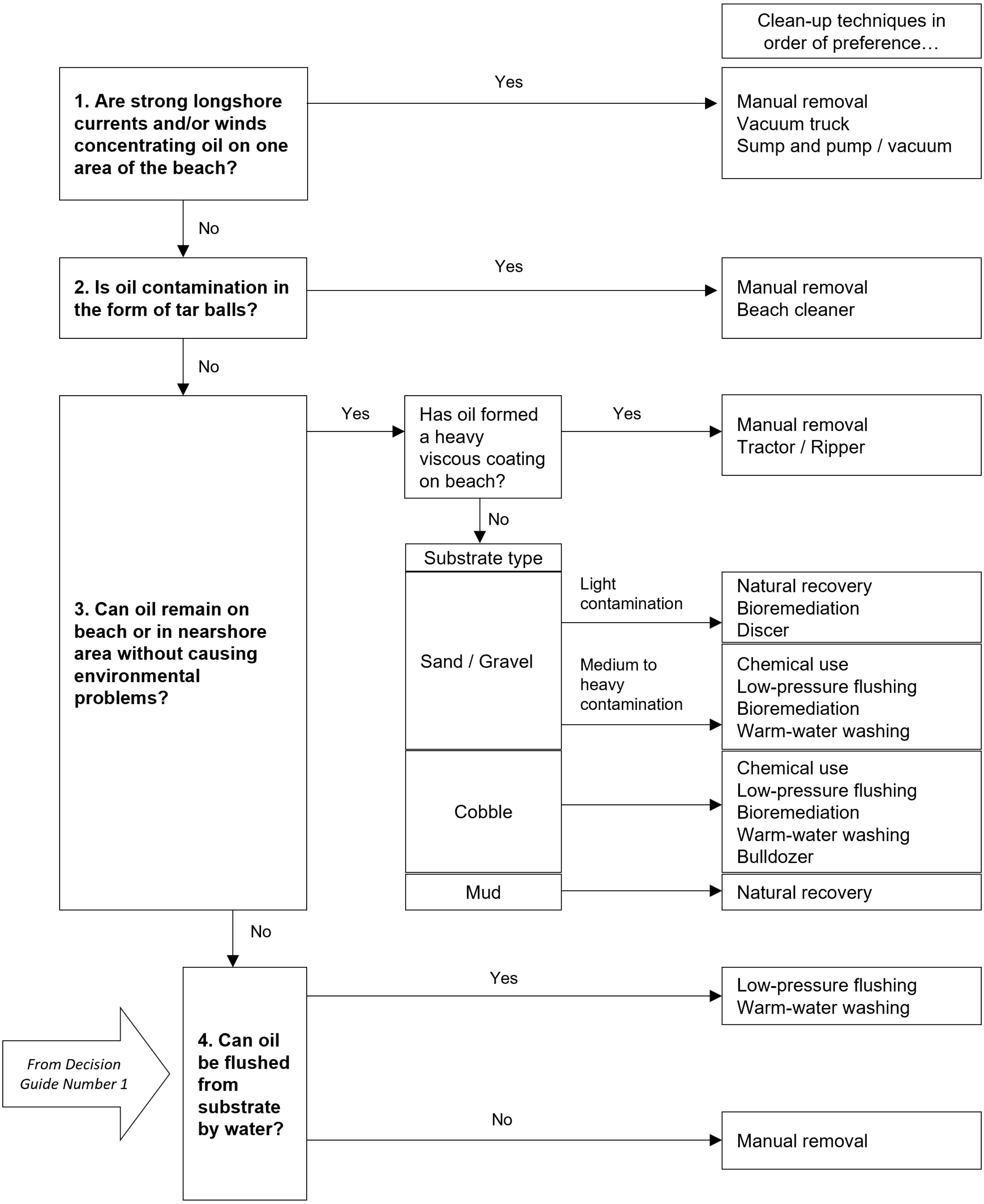


Figure K-3: Shoreline Clean-Up Decision Guide 2

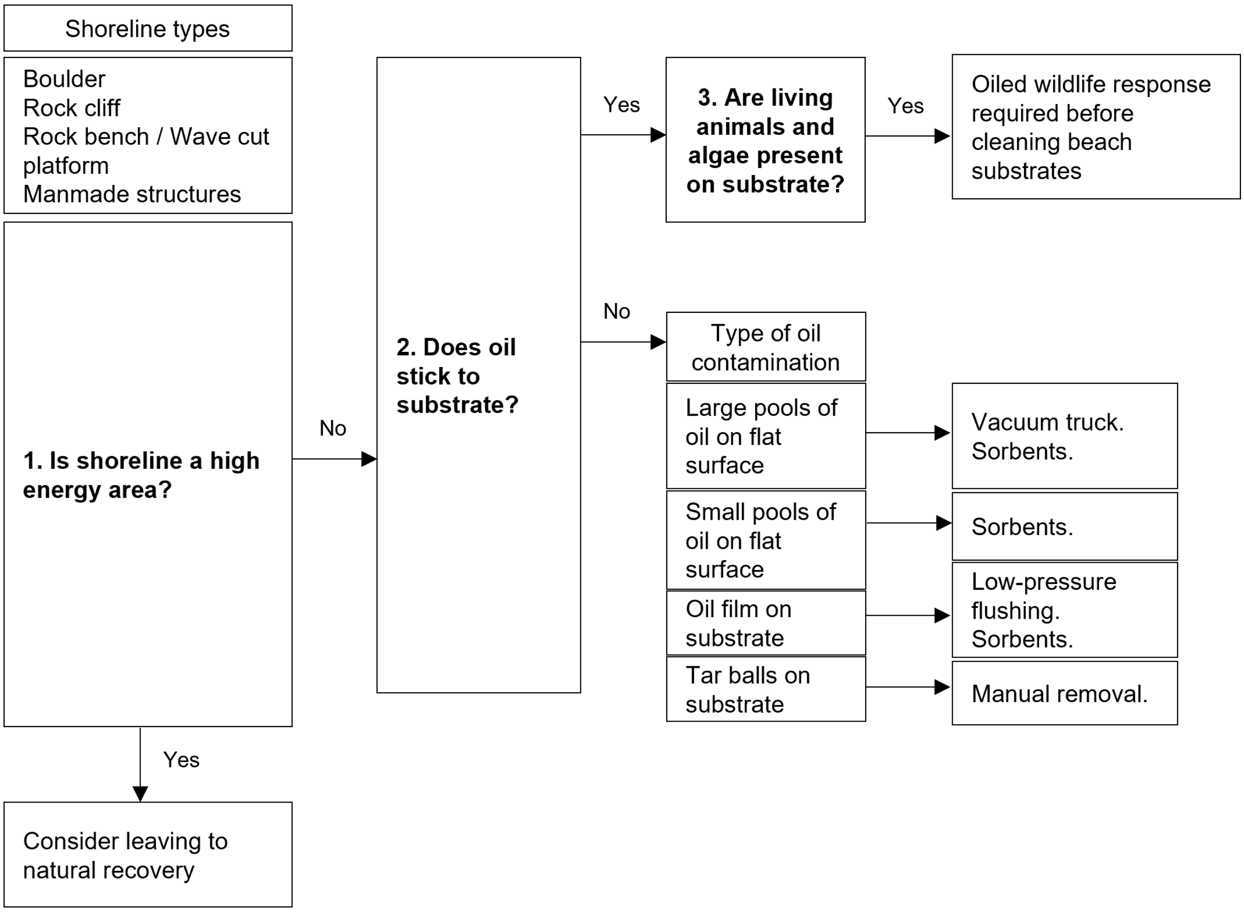


Figure K-4: Shoreline Clean-Up decision Guide 3

Appendix L Operational guidelines for shoreline response

L-1 Worksite preparation guidelines

The following provides guidelines for the preparation of staging areas supporting shoreline clean-up operations.

Organisation and worksite set-up

The worksite does not only include the polluted areas that require cleaning. Several other specific areas must be identified and cordoned off and routes for pedestrians and vehicles should be signposted.

These specific areas are:

- The polluted area;
- The waste storage area, with different types of containers suitable for the different kinds of waste;
- The decontamination area: whatever the size of the spill, a decontamination phase for operational personnel, equipment and tools must be carried out in order to provide some comfort to personnel after each work session, avoiding oiling clean areas, and group together personal clean-up equipment and protective gear, to facilitate the management of the site (cleaning, storage, re-use);
- A rest area, with at least changing rooms, toilets, a first aid kit and cold and hot beverages. Cold or even hot meals can also be organised on the spot provided that a canteen tent or temporary building is available; and
- A storage area for tools and machinery (or equipment warehouse).

Access to the worksite should be restricted and traffic of vehicles should be strictly regulated to avoid accidents.

Preparation

- Prevent the general public from accessing the worksite;
- Delineate accesses for vehicles and machinery (check load-bearing capacity) and routes;
- Channel vehicle and pedestrian traffic;
- Protect the ground (geotextile, roll out mat system…) during operations in sensitive areas (dunes...);
- Prepare and signpost the different areas of activity (on the beach), living areas (locker room, meals, showers, toilets...) and stockpiling areas presenting a risk (fuel, equipment, waste pit....);
- Define a site for fluid storage away from the locker room:
  - Provide an extinguisher for each cabin
  - Set up a recovery system for fuel leaks
- Provide at least minimum lighting for installations and the surrounding area during the winter.

Basic Equipment	Extra Equipment
• Plastic liners, geotextiles • Barrier tape and stakes • Signposting equipment	• Bins, barrels, skips, tanks • Hot and cold beverages Welfare) • Cooking oil, soap (Welfare) • Earthmoving equipment

Primary Storage of Waste

A primary storage site is:

- An emergency staging area of the immediate deposit of the waste collected before its transfer to either an intermediate long term storage site or if possible directly to a treatment facility; and
- A key stage in the waste management process for sorting, labelling and quantifying the types and volumes of waste collected and when possible, reducing volumes to be transported by pre-treatment.

The storage site must be closed as soon as clean-up operations are completed.

The return of the site to its original condition implies:

- A contamination diagnosis made by an organisation specialised in ground pollution, decontamination operations if needed and the approval of the authorities; and
- In some cases, botanical evaluations to define a plant cover restoration operation.

- Segregate the different types of waste
- Protect containers from rain water and to contain odours
- Protect containers from prolonged exposure to sunlight if necessary
- Ensure security to prevent unauthorised dumping

Primary waste storage sites should meet certain criteria:

- Close proximity to the site of clean-up;
- Good access to roads for heavy lorries; and
- A flat area with enough space away from environmentally-sensitive areas (vegetation, groundwater) and out of reach of the sea tides and waves.

- Depending on the volume of waste, site characteristics and availability of containers, prepare:
  – Staging areas
  – Pits if necessary
  – Platform within earth berms
  – Platform for bagged solids and liquids in tank.
- Protect areas using watertight plastic liners
- Lay fine gravel or sand at the base of the storage area to protect the membranes
- Prepare rain water or effluent management
- Ensure correct labelling of the containers to avoid mixing the different types of waste (liquid, solid, non-biodegradable – oiled plastics, contaminated cleanup equipment, biodegradable – oiled seaweed, faunal)
- Control access to the cleanup sites and protect access routes using lining and/or geotextiles

Base Camp / Rest Area

The rest area (base camp) should at least consist of:

- Changing rooms;
- Toilets; and
- A rest area.

At base camp, operators must be provided with:

- A first aid kit; and
- Hot and cold beverages, meals.

Selection of the rest area must meet certain criteria:

- Close proximity to the clean-up site;
- Easy access; and
- A flat area with enough space away from environmentally sensitive areas.

Equipment

- Shelter/rest area (tent, temporary building;
- Portable toilets (at least one for men and one for women);
- Locker rooms;
- First aid kit;
- Fire extinguisher; and
- Communication equipment.

Storage Area for Equipment and Machinery

This area consists of and equipped repair and maintenance site.

In order to avoid incidents and clean-up equipment failures, equipment should only be used by trained personnel and all equipment should regularly be checked for conformity with standard operating procedures and safety.

- Check and adjust daily levels of gasoline, diesel, oil, water and other fluids
- Regularly maintain the machines (pumps, pressure washers...)
- Equipment must be checked, counted by the person in charge of logistics and stored daily at the end of the work day
- Some pieces of equipment must be washed or at least rinsed daily, with proper recovery of cleaning effluent, other kinds of equipment should be washed weekly or at the end of operations
- Set up a systematic maintenance-cleaning-repair operation at the end of each week
- Small tools and equipment and even detachable parts of all equipment remaining outside should be securely stored away (eg stainless steel bucket of small sand screeners)
- In case of interruption of operations, large pieces of equipment should be moved to a supervised site
- Regularly check equipment for conformity and safety

The storage area for equipment and machinery must meet certain criteria:

- Close proximity to the site of clean-up;
- Easy access; and
- A flat area with enough space away from environmentally-sensitive areas.

Equipment

- Cabins;
- Hut;
- Maintenance equipment and tools; and
- Cleaning equipment.

L-2 Manual clean-up guidelines

Oil, polluted sediment and debris are removed by hand or with the help of manual tools and then stored for disposal.

Conditions of use

- Pollution : all types ; most often scattered pollution; on large spills, if implementation of other techniques is impossible;
- Pollutant : all types;
- Substrate : all types; sufficient load bearing capacity for pedestrians and light equipment; and
- Site: all types sufficiently accessible and which tolerate intensive traffic.

Equipment

Basic Equipment:

- Scrapers (paint scrapers, long handle scrapers...), rakes, brushes, forks; and
- Landing nets, shovels, trowels.

Extra Equipment:

- Waste containers, big bags, bins, plastic bags; and
- Front-end loader (for disposal).

PPE: At least protective clothing: overalls, boots, gloves, etc. depending on the nature of the pollutant, expose and responder activity.

- Divide the response personnel among three functions:
  - Collection/scraping/gathering
  - Placing in bags/waste containers
  - Disposal
- Rotate the teams among the three functions;
- The waste can be disposed of manually or with the use of mechanical means if possible;
- Don’t overfill bins, plastic bags; and
- Don’t remove excessive quantities of sediments.

Impact

- Impact insignificant to heavy, depending on the type of substrate. Risk of destroying the structure of the substrate in marshes. Erosion;
- Potentially destructive effects on vegetation (dunes, marshland);
- Deconstruction and destabilisation of the foot of the dune (upper end of beach); erosion, destruction of the dune and the associated vegetation, decrease in biodiversity and fertility by reduction of the low water mark; and
- Can tend to fragment the oil in certain conditions.

Performance

This is a highly selective technique, but requires a lot of time and personnel. If not done correctly, there is a risk of removal of large quantities of clean sediment.

L-3 Mechanical clean-up guidelines

This technique consists of collecting the oil in order to facilitate its removal from the beach. Collection is carried out using a tractor, ATV or earthmoving vehicle or earthmoving equipment.

Conditions of use

- Pollution : heavy pollution, continuous slick;
- Pollutant : slightly to very viscous oil;
- Substrate : vast, flat foreshore with wet fine-grain sand (very damp to saturated) and a good load-bearing capacity, without ripple marks; and
- Site: accessible and sufficient load bearing capacity for earthmoving equipment, sufficiently large to allow vehicles to manoeuvre.

Equipment

Basic equipment:

- Backhoe loader;
- Grader/bulldozer;
- Tractor or loader with front blade; and
- Front-end loader or lorry (for removal).
- PPE: At least suitable for heavy machinery operation

Impact

- Normally only removes the oil, but some sediment may also be taken with it (if the operator is poorly supervised or inexperienced), especially if used on light pollution or an unsuitable site;
- High risk of disturbance due to traffic and mixing of oil with sediment; and
- May lead to reduction of beach stability and beach erosion/loss of beach area.

Minimum workforce required: 2 people per vehicle (1 drive + 1 assistant).

Waste: oil mixed with a varying quantity of sediment; but can rapidly become unselective if scraping is carried out on moderate pollution (should be avoided).

- Consists of bringing the oil together in order to facilitate its removal from the beach. Scraping is carried out using a tractor or earthmoving equipment fitted with a front end blade in an oblique position. According to the viscosity of the oil, two options are available:
  - (case 1) fluid oil: radial or converging scraping towards a collection point on the foreshore; removal by pumping
  - (case 2) more viscous oil /solids: concentration to form windrows, by successive slightly curing passes parallel to the water line; subsequent removal of windrows
- Should only be carried out on heavy pollution; do not use on moderate to light pollution
- Inform and supervise operators; use experienced operators
- Work methodically
- Set up traffic lanes on the beach in order to reduce oil and sediment mixing
- Don’t remove excessive amounts of non-contaminated materials
- Don’t fill the bucket of loader more than 2/3 capacity
- Don’t drive on polluted materials

L-4 Shoreline vessel access guidelines

There are numerous landing craft vessels available in the North West Shelf area. These vessels are capable of grounding out; therefore the vessels can access a contacted area on high tide, ground out, unload equipment and personnel, reload with waste oil then depart on the next high tide. The Santos Offshore - Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) describes the specifications for beach landing craft, and describes Santos vessel monitoring processes.

Mechanical equipment and PPE are to be mobilised to the nominated marine operational base for onward movement to the affected locations.

For shoreline clean-up of remote islands, the following guidelines will be considered so as to minimise the secondary impacts of high numbers of spill response personnel on shorelines:

Vessels are to be mobilised to the designated deployment Port to mobilise shoreline clean-up teams by water. The shoreline clean-up will be undertaken through on-water deployment to the defined shorelines in 4 stages:

1) Drop off of 6-person clean-up containers to shoreline contact locations defined by IMT through observation data;
2) Deployment of marine and environmental specialists to demarcate the clean-up zones with barrier posts and tape to prevent secondary contamination impacts to flora and fauna by the clean-up teams;
3) Deployment of small clean-up teams with a trained/competent shoreline responder as a Team Leader to conduct clean-up methods (flushing, bag and retrieve, etc.) with all waste being bagged and stored in temporary bunding made of HDPE above the high-tide mark; and
4) Deployment of waste pickup barges to retrieve collected wastes from the temporary bunding and to complete the shoreline clean-up and final polishing.

Appendix M Oiled wildlife response personnel and equipment

In the event of a spill impacting wildlife, Santos will commence arrangements to mobilise personnel and equipment to fill responder positions as identified in the Santos Oiled Wildlife Response Framework Plan (SO-91-BI-20014) and WAOWRP.

This appendix outlines the current OWR equipment, personnel and services available to Santos through current arrangements.

Overall OWR capability per OWR strategy

The overall OWR capability of Santos is outlined in Table M-1. Santos has access to aircraft that could be used for wildlife reconnaissance within hours of a spill. This would be followed by further access to vessels and Santos personnel trained in OWR that could be mobilised within 24 hours for vessel and wildlife shoreline reconnaissance, demonstrating Santos' ability to mount a swift response that could also be sustained as long as required.

Santos has the capability to set up oiled wildlife field stations within 3–4 days of a spill through access to AMOSC equipment and equipment purchased at the time of a spill. Santos could also arrange the transport of wildlife from the field to a primary care facility.

The indicative personnel required for a high impact-rated response is 93 personnel (as per the WAOWRP) (DBCA, 2022a); however, depending on the number and species impacted, may require many more. Santos' current arrangements could support a large scale OWR (requiring >93 personnel) mainly through support staff, such as, non-technical wildlife support roles (management, logistics, planning, human resourcing, transporter, cleaners, trades persons, security etc.). These roles could be filled by Santos personnel and labour hire agencies that can provide workers that undergo an induction and basic training. In addition, many of the roles required for an OWR require technical expertise and Santos will need to activate OWR arrangements with AMOSC and OSRL to fulfil roles, as well as make contractor arrangements for accessing skilled wildlife personnel at the time of a spill.

Table M-1: Santos OWR capability per OWR strategy

OWR strategy	Considerations	Equipment/personnel	Location	Mobilisation timeframe
Reconnaissance	Identify opportunities to create synergies with surveys required for Monitor and Evaluate and Scientific Monitoring activities	Rotary-wing aircraft & flight Crew	Karratha Learmonth Onslow	Wheels up within 1 hour for Emergency Response.
		Drones and pilots	Local WA hire companies	1–2 days
		Contracted vessels and vessels of opportunity Santos-contracted vessel providers Vessels of opportunity identified through AIS Vessel Tracking	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.
		Aerial surveillance crew Santos staff AMOSC staff AMOSC Core Group personnel available Additional trained industry mutual aid personnel available	Perth and Varanus Island (VI) (Santos aerial observers) Australia wide	Santos-trained personnel – next day mobilisation to airbase <24 hours
Preventive actions	Mainly effective for bird species Requires relevant WA/NT licence approval	5 AMOSC wildlife fauna hazing and exclusion kits 1 AMOSC Breco buoy	4 Fremantle, 1 Geelong 1 Fremantle	Location dependent
Rescue and field processing	Wildlife handling and first aid should only be done by persons with appropriate skills and experience or under the direction of DBCA/ DEPWS	4 AMOSC oiled fauna kits (basic medical supplies, cleaning/rehab, PPE)	1 Exmouth, 1 Broome, 2 Geelong	Location dependent
		2 DBCA OWR trailers	1 Kensington NSW 1 Karratha WA	Location dependent
		50% of OSRL OWR response packages (Wildlife search and rescue kits / cleaning and rehabilitation kits, including field first aid)	5 Singapore, 2 Bahrain, 7 UK, 5 Fort Lauderdale	Location dependent
Transport	Transport of oiled animals by aeroplane or helicopter may be restricted due to Civil Aviation Safety Authority (CASA) regulations; such transport will depend on the level of oiling remaining on animals. Therefore, consultation with the air transport provider must take place before transport to ensure the safest and most efficient means	Contracted vessels and vessels of opportunity Santos-contracted vessel providers Vessels of opportunity identified through AIS Vessel Tracking	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.
Primary care facility	OWR container could be placed on the deck of a suitably sized vessel for field	OWR container/mobile washing facility 2 AMOSC	AMOSC – 1 Fremantle, 1 Geelong	Location dependent

OWR strategy	Considerations	Equipment/personnel	Location	Mobilisation timeframe
	processing in remote locations (benefits associated with temperature regulation and access to water and electricity) An OWR container on a vessel could also be used to aide transport form offshore islands	4 AMSA 2 DoT	AMSA – 1 Dampier, 1 Darwin, 1 Devonport, 1 Townsville DoT – 1 Fremantle (AMOSC warehouse), 1 Sydney	
		AMOSC call-off contract with DWYERTech NZ – a facilities management group	New Zealand	Availability within 24 hours of call-off
Personnel	Untrained personnel would receive an induction, on-the-job training and work under the supervision of an experienced supervisor	Santos provides OWR training to staff, and to-date, ~20 personnel have received OWR training	Perth and Varanus Island	<48 hours
		Santos maintains labour hire arrangements for access to untrained personnel		
		1 AMOSC Oiled Wildlife Advisor	Perth, WA	<48 hours
		62 trained industry personnel (AMOSC OWR Strike Team members)	-	<48 hours
		AMOSC MoU with Phillip Island National Park (PINP) (best-endeavour availability)	Victoria, Australia	Best-endeavour availability
		AMOSC MoUs – WA organisations	WA	Best-endeavour availability
	Sea Alarm Via OSRL's contract with the Sea Alarm Foundation, 2 OWR technical advisors are on call to support Members. Sea Alarm staff act in a technical advisory role and do not engage in hands-on OWR activities but work impartially with all parties (Titleholder, local authorities, mobilised experts and local experts, and response groups), aiming to maximise the effectiveness of the wildlife response.	1 OWR Technical Advisor available for deployment in-field or at the Command Post (typically supporting the Wildlife Branch Director or the Planning and Operations sections) 1 OWR Technical Advisor available to support remotely.	Sea Alarm Belgium	Location dependent. Notification via existing OSRL notification and mobilisation process.
	GOWRS Oiled Wildlife Assessment Service Through OSRL's ongoing funding of the Global Oiled Wildlife Response Service (GOWRS) project, a wildlife assessment team of 4 wildlife experts can be mobilised in-field to provide an on-the-ground technical assessment of wildlife response needs and the professional capabilities of local responders.	4 wildlife experts can be mobilised in-field for up to 4 days. Access to additional oiled wildlife resources on a 'reasonable endeavours' only basis through the GOWRS partners	Various locations in northern and southern hemisphere	Location dependent. Notification via existing OSRL notification and mobilisation process.

Australian Maritime Safety Authority (AMSA)

AMSA maintains 4 x OWR containers/ mobile washing facilities in Dampier, Darwin, Devonport and Townsville. All resources under the National Plan (including the 4 OWR containers) are available to Santos through formal request to AMSA under the arrangements of the National Plan. The containers also include some limited PPE and fresh and wastewater pools.

Western Australia Department of Transport (DoT)

The WA DoT maintains 2 x OWR containers/ mobile washing facilities (WA – Fremantle – AMOSC warehouse, and NSW Sydney), which are available through the SHP-MEE and the AMSA National Plan on request.

Australian Marine Oil Spill Centre (AMOSC)

Santos is a Participating Member of AMOSC and as such has access to AMOSC's Level 2/3 oiled wildlife equipment and personnel as outlined in the AMOSPlan.

Equipment

Table M-2 summarises the OWR equipment maintained by AMOSC.

Table M-2: AMOSC wildlife equipment

Location	Oiled fauna kits (basic medical supplies, cleaning/rehab, PPE)	Fauna hazing and exclusion equipment	Oiled wildlife washdown container (mobile washing facility)
Fremantle	-	4 fauna hazing & exclusion kit 1 Breco bird hazing buoy	1 oiled wildlife washdown container
Exmouth	1 Oiled fauna kit	-	-
Broome	1 Oiled fauna kit	-	-
Geelong	2 Oiled fauna kit	1 fauna hazing & exclusion kit	1 oiled wildlife washdown container
Total	**4 Oiled fauna kit**	**5 fauna hazing & exclusion kits** **1 Breco bird hazing buoy**	**2 oiled wildlife washdown containers**

Personnel

AMOSC currently has the following arrangements in place for OWR personnel:

- 1 AMOSC OWR Officer available to act as an Industry Oiled Wildlife Advisor (OWA)
- 62 trained industry personnel (AMOSC OWR Strike Team members)
  - Volunteer OWR trained industry personnel
- Wildlife Care Groups:
  - 35 introductory trained personnel
  - 24 completed management course
  - 16 completed Responder course
- AMOSC call-off contract with DWYERTech Response NZ
  - A facilities management group with availability within 24 hours of call-off – 2 personnel

AMOSC has the following MoUs in place:

- Phillip Island National Park (PINP; Victoria) (best-endeavour availability)
- ~50 PINP staff – collection/facility ops/rehabilitation
  - ~45 volunteers – collection/facility ops/rehabilitation
  - ~20 staff – animal feeding
  - 6 PINP staff – wildlife emergency response including cetacean stranding/entanglement

  - 17 PINP staff – wildlife team leaders
  - 5 PINP staff – IMT Training
- Blue Planet Marine (WA)
  - 10–20 personnel (best endeavours to respond)
- WA Seabird Rescue
  - No permanent staff, ~30 volunteers
- WA Native Animal Rescue
  - 5 staff, ~80 volunteers
  - Wangara – Avifauna and mammals
  - Broome – Marine turtles
- WA Wildlife
  - 10 staff, ~80 volunteers
- Darling Range Wildlife (WA)
  - 5 staff, ~50 volunteers
- Mandurah Wildlife (WA)
  - 5 staff, ~30 volunteers

Oil Spill Response Limited (OSRL)

Through their associate membership, Santos has access to the following OWR equipment and personnel services from OSRL.

Equipment

OSRL maintains a Level 3 wildlife equipment stockpile. This equipment is stored across the OSRL base locations and is designed to support the first 48 hours of the response and to ensure availability of critical equipment items that may be difficult to source locally (Note: This equipment does not provide everything that will be required to successfully operate a primary care facility and is focused primarily on bird casualties [n=100]). Equipment is sorted according to search and rescue (including field first aid), medical, and cleaning and rehabilitation (Table M-3).

Table M-3: OSRL wildlife equipment (as per OSRL Equipment Stockpile Status Report, April 2024)

OWR Response Package	UK	Singapore	Bahrain	Fort Lauderdale
Wildlife Search and Rescue BHR	-	-	-	-
Wildlife Cleaning and Rehabilitation Part 1	2	1	1	1
Wildlife Cleaning and Rehabilitation Part 2	2	1	-	1
Wildlife Cleaning and Rehab. Medical	1	1	-	1
Wildlife Search and Rescue	1	1	1	1
Wildlife Search and Rescue Medical	1	1	-	1

Personnel

Through the OSRL SLA, Santos has access to 24/7 technical advice (remote or on-site) from the Sea Alarm Foundation, a small non-governmental organisation based in Brussels, Belgium that works to improve global preparedness and response for oiled wildlife incidents. Two Technical Advisors are available, with one providing remote support and the other available to be mobilised for on-site support, either in-field or at the Command Post (typically working with the Wildlife Branch Director or the Planning and Operations sections as appropriate). Sea Alarm staff will act in a technical advisory role at the incident management level and will work impartially with all parties (Titleholder, local authorities, mobilised experts and local experts, and response groups), with the aim of maximising the effectiveness of the wildlife response.

Through OSRL's ongoing funding of the GOWRS Project, a wildlife assessment team of 4 wildlife experts can be mobilised in-field for up to 4 days in addition to the Sea Alarm resources noted above. The GOWRS Oiled Wildlife Assessment Service is a ready-to-deploy 4-person team delivered by a network of 10 leading wildlife response organisations. The four-person team will initially deploy for 4 days to provide an on-the-ground technical assessment of wildlife response needs and the professional capabilities of local responders. The team will inform the client of the feasibility of a full-scale professional response and the details of the GOWRS expertise that is available to deliver to the scale of such a response. There is also access to additional oiled wildlife resources on a 'reasonable endeavours' only basis through the GOWRS partners.

In addition, through the SLA, Santos has the option to access OSRL's internal staff with OWR expertise (1 in the UK) as part of the 18 personnel commitment for any single incident.

Appendix N Operational and scientific monitoring capability

The Northern Australia OSM-BIP (7715-650-ERP-0003) defines the 3-step process for ensuring that OSM capabilities of each activity are adequately covered by the existing information described within the Northern Australia OSM-BIP (Section 1.1 and Appendix A of the Northern Australia OSM-BIP).

Step 1: Determine if the activity EMBA fits within the Northern Australia OSM-BIP Combined EMBA

Comparison of the EMBA for Barossa Production Operations activities (Figure 3-1 in the Barossa Production Operations EP [BAA-200 0637]), shows that this fits within the Northern Australia OSM-BIP Combined EMBA (Figure 2-1 in the Northern Australia OSM-BIP).

Step 2: Determine the locations requiring a baseline review and whether these locations are currently included in the Northern Australia OSM-BIP

As per Section 2.2 of the Northern Australia OSM-BIP, receptors requiring a baseline data review were identified as those sensitive receptors contacted by hydrocarbons at the low threshold for floating (≥1 g/m^2), shoreline contact (≥10 g/m^2), entrained (≥10 ppb), and dissolved (≥10 ppb) within 7.0 days at a probability >5%.

The locations requiring a baseline data review for this activity are presented in Table N-1, and are included within Table 2-2 of the Northern Australia OSM-BIP.

Step 3: Determine whether the capability requirements and monitoring arrangements of the new activity exceed or are met by the capability requirements outlined in Section 8 and capability arrangements described in Sections 9 and 10 of the Northern Australia OSM-BIP

As per the criteria outlined in Appendix A of the Northern Australia OSM-BIP, less than 6 emergent receptors are contacted within 7 days at a probability of >5% (refer to Table N-1). Therefore, the OSM capability requirements for Barossa Production Operations activities are met by the worst-case capability requirements presented in Section 8 of the Northern Australia OSM-BIP. Therefore, additional deterministic modelling for Barossa Production Operations activities is not required to inform OSM first-strike capabilities.

The results of the annual baseline assessment are provided within the Environment Functional Team Folder on the Santos ER SharePoint so that this information is accessible to guide Santos IMT environmental roles and OSM services provider roles in the event of activating oil spill scientific monitoring.

Table N-1: Barossa Production Operations modelling results for locations with a probability of contact ≥5% and <7 days

Scientific monitoring priority area	Probability (%) entrained oil at ≥10 ppb	Min. arrival time ≥10 ppb (days)	Total contact probability (%) floating oil ≥1g/m²	Min. arrival time ≥1g/m²	Total contact probability (%) shoreline oil ≥10 g/m²	Min. arrival time ≥10 g/m²
Surface release of condensate from the FPSO (16,700 m³ released over 1 hour)						
Margaret Harries Bank*	21.00	4 days: 15 hours	3.67	6 days: 6 hours	-	-
Outer Oceanic Shoals AMP*	20.33	2 days: 13 hours	2.33	2 days: 19 hours	-	-
Sunrise Bank*	35.00	1 day: 9 hours	4.67	1 day: 13 hours	-	-
The Boxers Area*	11.33	4 days: 15 hours	1.67	4 days: 12 hours	-	-
Surface release of HFO from the offtake tanker (460 m³ released over 1 hour)						
Echo Shoals*	NC	NC	5.67	6 days: 19 hours	-	-
Margaret Harries Bank*	NC	NC	6.33	3 days: 9 hours	-	-
Outer Oceanic Shoals AMP*	0.67	1 day: 22 hours	6.00	1 day: 9 hours	-	-
Sunrise Bank*	1.67	1 day: 13 hours	15.33	1 day: 6 hours	-	-
Surface release of MGO from the FPSO (2,418 m³ released over 1 hour)†						
Margaret Harries Bank*	23.00	5 days: 9 hours	1.33	5 days: 11 days	-	-
Outer Oceanic Shoals AMP*	19.00	2 days: 14 hours	1.00	3 days: 2 hours	-	-
Sunrise Bank*	30.67	1 day: 6 hours	3.33	2 days: 19 hours	-	-
The Boxers Area*	8.00	3 days: 13 hours	0.67	3 days: 12 hours	-	-
Surface release of MDO from a vessel (500 m³ released over 1 hour)						
Afghan Shoal*	13.33	22 hours	0.33	1 day: 17 hours	-	-
Beagle Gulf–Darwin Coast	21.00	3 days: 10 hours	0.33	3 days: 11 hours	1.00	4 days: 11 hours
Cape Hotham#	16.00	5 days: 9 hours	NC	NC	0.33	11 days: 9 hours
Flat Top Bank*	13.00	3 days: 19 hours	NC	NC	-	-
Hancox Shoal*	27.67	4 days: 3 hours	NC	NC	-	-
Harris Reef*	20.67	4 days: 21 hours	NC	NC	-	-
Joseph Bonaparte Gulf – East Coast	10.00	5 days: 3 hours	NC	NC	0.33	7 days: 22 hours
Lowry Shoal*	22.33	3 days: 14 hours	NC	NC	-	-
Marsh Shoal*	22.67	4 days: 23 hours	NC	NC	-	-

Scientific monitoring priority area	Probability (%) entrained oil at ≥10 ppb	Min. arrival time ≥10 ppb (days)	Total contact probability (%) floating oil ≥1g/m²	Min. arrival time ≥1g/m²	Total contact probability (%) shoreline oil ≥10 g/m²	Min. arrival time ≥10 g/m²
Moresby Shoals*	21.00	3 days: 13 hours	NC	NC	-	-
NT waters*	67.67	1 hour	54.33	1 hour	-	-
Outer Oceanic Shoals AMP*	7.67	7 days	NC	NC	-	-
Shepparton Shoal*	33.67	6 hours	6.00	7 hours	-	-
Skottowe Shoal*	22.67	3 days: 14 hours	NC	NC	-	-
The Boxers Area*	12.67	2 days: 18 hours	0.33	2 days: 18 hours	-	-
Tiwi Islands	20.00	1 day: 19 hours	0.33	2 days: 16 hours	0.33	3 days: 7 hours
Van Diemen Gulf Coast	10.33	6 days: 17 hours	NC	NC	NC	NC
Van Diemen Gulf Shoals*	18.67	5 days: 5 hours	NC	NC	-	-
Vernon Islands CR	28.67	4 days: 14 hours	NC	NC	1.67	5 days: 14 hours

**Submerged receptor that has no features above the sea surface. Modelling indicates 'contact' with these receptors when the hydrocarbons pass over the receptor on the sea surface.*

NC: No contact to receptor predicted for specified threshold

† MDO was modelled for this scenario, as comparison of MGO and MDO properties shows that MDO is marginally the more persistent product, and hence the more conservative of the two hydrocarbon types

[#] Djukbinj National Park polygon named in the modelling report (RPS, 2023) refers to the area Cape Hotham. There is no hydrocarbon contact with Djukbinj National Park.

Source: RPS, 2023

Appendix O Resourcing requirements for OMP: Shoreline clean-up assessment

Each shoreline clean-up assessment team will comprise 2–3 members and each team is assumed to be able to cover 10 km per team per day. Teams may be able to exceed this distance, especially if remote sensing techniques (e.g. UAVs) are used to cover shorelines that have access limitations, which includes many receptor locations in the EMBA.

Santos used both stochastic and deterministic modelling data for shoreline contact to plan personnel requirements for the worst-case shoreline and habitat assessment. Table O-1 presents all receptors contacted at ≥100 g/m² using the stochastic modelling results for the HFO spill scenario (surface release of HFO from the offtake tanker [460 m^3 released over 1 hour]) —the scenario with the greatest overall contact and length of oiled shoreline—along with the SCAT planning considerations and estimated number of SCAT teams required.

Note: Not all the receptors listed in Table O-1 will be contacted by one single spill. These results present the range of possible worst-case timeframes to contact and length contacted based on all runs that make up the stochastic model. Santos will use initial monitor and evaluate data (e.g. trajectory modelling and aerial surveillance) to determine where resources should be allocated. This may include directing resources to conduct SCAT at locations not identified as Protection Priority Areas, to determine if protection and clean-up activities may be required at these receptors.

Initially, shoreline clean-up assessment may be conducted via reconnaissance surveys and later confirmed via ground and/or vessel surveys.

Deterministic run #99 from the HFO spill scenario (surface release of HFO from the offtake tanker [460 m^3 released over 1 hour]) (Table O-2) was selected to guide resourcing estimates for SCAT because it had the maximum volume of oil ashore ≥100 g/m^2, one of the maximum lengths (20 km) of shoreline oiled at ≥100 g/m^2, and a short time (9 days: 21 hours) for oil accumulation ≥100 g/m^2. Run #45 for the FPSO release scenario (surface release of condensate from the FPSO [16,700 m^3 released over 1 hour]) had the longest length of shoreline contacted ≥100 g/m^2 at 28 km, but was not contacted until day 17. Based on run #99 from the HFO spill scenario (Table O-2), the worst-case personnel requirements are 4–6 personnel—2 teams with 2–3 personnel each (1 Team Leader and 1–2 Team Members).

The personnel resourcing numbers for SCAT are listed in Appendix Q (Cumulative Response Capability Assessment). Table O-3 lists the resource capability available to Santos that may be used to implement SCAT.

Table O-1: Resource requirements for shoreline clean-up assessment for all locations contacted ≥100 g/m² based on stochastic results for HFO spill (RPS, 2023)

Location	Minimum arrival time shoreline oil accumulation ≥100 g/m² (days:hours)	Maximum length of shoreline oiled (km) ≥100 g/m²	Planning considerations	Estimated No. of teams required
Ashmore Reef AMP	29 days:6 hours	28	Island surrounded by intertidal habitat. Shallow vessels required.	1
Cobourg Peninsula – Nhulunbuy	30 days:11 hours	75	Remote mainland locations with poor accessibility and presence of saltwater crocodiles, making ground surveys unsuitable. Some small airstrips exist in the region. Using UAVs and/or suitable vessels may be more suited to these conditions.	3–4
Cape Hotham#	36 days:19 hours	6		1
Indonesia East and Timor-Leste	9 days:6 hours	93	International receptor. Access varies across the receptors.	5–6
Minor Indonesian islands	13 days:21 hours	40		4
Tiwi Islands	37 days:9 hours	61	These islands are located close to each other so sharing resources is preferable.	3–4

Location	Minimum arrival time shoreline oil accumulation ≥100 g/m² (days:hours)	Maximum length of shoreline oiled (km) ≥100 g/m²	Planning considerations	Estimated No. of teams required
Van Diemen Gulf Coast	37 days:7 hours	11	Remote mainland location with limited accessibility and presence of saltwater crocodiles, making ground surveys unsuitable. Using UAVs and/or suitable vessels may be more suited to these conditions.	1–2
Vernon Islands CR	35 days:22 hours	17	These islands are located close to each other so sharing resources is preferable.	1–2

Note: SCAT numbers not to be added up from this table as spill will not contact all receptors modelled (as these are stochastic results). Number of personnel required will be based on direction of spill and timeframes to contact.

[#] Djukbinj National Park polygon named in the modelling report (RPS, 2023) refers to the area Cape Hotham. There is no hydrocarbon contact with Djukbinj National Park.

Table O-2: Resource requirements for shoreline clean-up assessment for protection priority areas based on HFO deterministic run #99 (RPS, 2023)

Location	Minimum arrival time shoreline oil accumulation ≥100 g/m² (days:hours)	Maximum length of shoreline oiled (km) ≥100 g/m²	Estimated No. of teams required
Indonesia East and Timor-Leste	9 days: 21 hours	20	2
Total estimated SCAT teams required			**2**

**Predominantly intertidal receptor apart from small dry emergent areas and therefore length of shoreline oiled likely to be less than model output*

Table O-3: Shoreline clean-up assessment – resource capability

Equipment type / personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Shoreline assessment team leaders	Santos	12	Perth, Varanus Island	<24–48 hours from time of shoreline contact prediction (WA-based, Santos personnel, AMOSC staff and Core Group personnel)
	AMOSC Core Group	60+ (industry Core Group)	Perth, Dampier and other Australian locations	
	AMOSC staff	12 trained in SCAT	Perth and Geelong	
	OSRL	18	Perth and international	5 personnel available from 2–3 days, remaining personnel available from 4–5 days (subject to approvals/ clearances)
Shoreline assessment team members	Santos-contracted workforce hire company (e.g. Dare)	As per availability (up to 2,000)	Australia-wide	Subject to availability (indicatively 72+ hours)
Drones and pilots ** To assist shoreline and vessel-based surveillance	AMOSC	Drones available 24/7 through AMOSC sub-contract 1 pilot	Fremantle	Response via Duty Officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location (refer to Table 10-12)
	OSRL – Third-Party UAV provider	2 qualified remote pilots, however response is on best endeavour	Perth	Depending on the port of departure, 1–2 days if within Australia

Equipment type / personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
	Local WA hire companies	10+	Perth and regional WA	<48 hours

Appendix P Forward operations guidance

The IMT operate from Perth within the Santos IMT room. These rooms are equipped and subject to reviews and updates as detailed in the Santos Incident Management Plan – Upstream Offshore (SO-00-ZF-00025).

To facilitate a streamlined response, forward operational bases are required close to the response operational areas equipped with near duplicated IMT equipment and personnel. Further information on FOBs is provided in the Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017).

Forward operating base (FOB)

For a significant Level 2/3 response requiring coordination of resources to be deployed to the field, Santos will establish a FOB. For a Level 2/3 spill crossing from Commonwealth to Territory / WA State waters (cross-jurisdictional spills) NT Control Agency / WA DoT will establish a FOB.

For a Barossa development activity spill response, Santos will establish a FOB in Darwin – details of the Darwin FOB are provided in the Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017).

Appendix Q Cumulative response capability assessment

Table Q-1 shows the total cumulative worst-case response needs for the Barossa Production Operations activities. The table assesses the cumulative requirement for personnel based on the predicted requirements from the worst-case resourcing for each response strategy. Note: During a real event, resourcing may be different to that listed in the table, based on an operational NEBA. This information is presented for assessment purposes only, to ensure adequate resources are available for worst-case response strategy implementation.

The personnel numbers in Table Q-1 represent the operational requirements. Additionally, it is assumed the total number of personnel required would be ~50% greater to cover shift arrangements to manage responder fatigue. It is estimated that 74 skilled field response personnel will be required to allow for shift changes across the response. Additional personnel requirements will be resourced through a combination of:

- ad hoc training for specific response strategy needs on a just-in-time basis
- sourcing additional personnel from OSROs on a case-by-case/ best endeavours basis.

Table Q-1: Cumulative response capability assessment

Function	Response strategy	HFO spill scenario (surface release of HFO from the offtake tanker [460 m³ released over 1 hour]) response need requirement	Capability to meet Barossa Production Operations requirement				
			Santos	AMOSC staff	Industry Core Group	OSRL	Mutual aid, contractors and service providers
Source control [52]		**39**	**39**	**-**	**-**	**-**	**Additional personnel available from WWCI and Oceaneering**[53]
Monitor and Evaluate	Vessel surveillance	2 vessel crew	-	-	-	-	2 vessel crew
	Aerial surveillance[54]	2 aerial observers 1 flight crew	-	1 aerial observer	1 aerial observer	-	1 flight crew
	Tracking buoys	1 vessel crew	-	-	-	-	1 vessel crew
	Oil spill trajectory modelling	*Services provided with no specific personnel numbers required.*					
	Satellite imagery	*Services provided with no specific personnel numbers required.*					
Containment and recovery		14 (2 C&R systems, each with 2 vessel masters, 1 supervisor, 4 deployment crew)	-	-	2 C&R supervisors	-	Vessel contracted: Vessel masters (2) and deployment crew (8)
Mechanical dispersion		*N/A – personnel as per vessel availability*	-	-	-	-	As per in-field vessel availability
Chemical dispersant application	Vessel-based application	2 vessels	-	2 supervisors	-	-	Vessel contracted: Vessel masters and deployment crew
	Surface application: Aircraft systems as per Table Q-2	16 personnel total	-	-	-	-	FWAD Contract: 14 Air Attack aircraft pilot + 1st Officer (Santos-contracted): 2
Shoreline protection and deflection	Protection and deflection resources as per Table 14-5	2 team leaders 18 Protection and deflection operatives (9 per team) 4 vessel crew (2 crew per team)	2 Protection and deflection supervisors	-	18 Protection and deflection team members	-	Vessel personnel as per contract.

[52] *The cumulative capability for Source Control is assessed on its own, as the resources do not impact other strategy implementation. 60 Santos source control personnel available.*

[53] *WWC has confirmed availability of 34 source control personnel.*

[54] *Based on 1 aircraft conducting 2 sorties per day.*

Function	Response strategy	HFO spill scenario (surface release of HFO from the offtake tanker [460 m³ released over 1 hour]) response need requirement	Capability to meet Barossa Production Operations requirement				
			Santos	AMOSC staff	Industry Core Group	OSRL	Mutual aid, contractors and service providers
Shoreline clean-up	Shoreline Clean-up Assessment (SCAT) resources as per Appendix O	Maximum of 2 teams (each with 1 team leader and 1–2 team members)	2 SCAT team leaders	-	4 SCAT team members	Available on request	Up to 2,000 team members available, who can complete shoreline assessment training, working under direction of team leader (contracted workforce hire company)
	Shoreline clean-up resources as per Table 15-5.	10–15 teams: 15 shoreline clean-up supervisors 150 team members	4 shoreline clean-up supervisors		8 shoreline clean-up supervisors	3 shoreline clean-up supervisors	Labour Hire: 150 team members, working under direction of Shoreline clean-up supervisors
OWR		Refer to Appendix M. Sourced as per the WAOWRP arrangements (High predicted impact) (DBCA, 2022a)					
Waste management		*N/A – personnel as per shoreline clean-up and OWR resourcing*	-	-	-	-	WSP to provide personnel under existing contract to collect and transport waste
OSM components (excluding SCAT)		Refer to Northern Australia OSM-BIP (7715-650-ERP-0003)					
Response need (excluding Source Control)			8	3	33	3	*Santos has contracts in place, or can appoint ad hoc contracts, to resource the above numbers required.*
Response need including +50% for shift change			12	6	50	5	
Total Available (excluding Source Control)			22[55]	16	100[56]	18	
Total Required Source Control			39	-	-	-	Additional personnel available from WWCI and Oceaneering
Total Source Control			39	-	-	-	

[55] *Santos personnel made up of 16 AMOSC Core Group members based across Perth, NW Australia and South Australia, and 6 IMO1 trained personnel based in Darwin.*
[56] *A total of 100 personnel in the Core Group as of July 2024 (AMOSC Member's website)*

Table Q-2: FWADC aerial dispersant application – Field resourcing requirements

Aerial dispersant resource	No. required per aircraft	No. aircraft	Total no. required	Source of personnel
Support location (AMOSC FWADC Airbase FOB, likely to be Darwin)*				
FOB Commander*	*N/A*	*N/A*	1	AMOSC FWADC contract
Airbase Manager*			1	AMOSC FWADC contract
Safety Officer*			1	AMOSC FWADC contract
Dispersant Operations Coordinator*			1	AMOSC FWADC contract
Dispersant Loading Crew*			2	AMOSC FWADC contract
Log/Admin*			1	AMOSC FWADC contract
		Airbase FOB total:	7	
AMOSC FWADC Dispersant Operations Group (at sea operations at application site)				
Dispersant application air tractors				
Air Tractor Pilot*†	1	3	3	AMOSC FWADC contract
Air Tractor First Officer*†	1	3	3	AMOSC FWADC contract
Air attack				
Secondary Overhead Aircraft Pilot†	1	1	1	Santos-contracted
Secondary Overhead Aircraft First Officer†	1	1	1	Santos-contracted
Air Attack Supervisor*	1	1	1	AMOSC FWADC contract
		Dispersant Group total:	**9**	
		Total personnel:	**16**	

* *These roles as per Aerotech First Response / AMOSC/ Core Group fixed-wing aerial response personnel resourcing in AMOSC FWADOps Plan* (AMOSC, 2022).

† *As stated in the FWADOps Plan, these roles are subject to CASA requirements. The numbers stated above are reasonable estimates.*

Appendix R Testing Arrangements Plan

R-1: Testing Arrangements Plan

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
1.	**Source Control**				
	Source Control a) Relief Well Drilling - Access to MODU	Review - MODU Register	Once per month for the duration of drilling campaign	Identify suitable MODU that can be utilized in the event of a Source control incident requiring a relief well	Document the identified suitable MODU by: • Name • MODU Type • Location • Contract Status
	Source Control b) Access to Capping Stack	Review – Contract / Agreement	Annually (when drilling activity is occurring)	To confirm access to capping stack for well capping	Review to confirm access to Capping Stack through maintenance of service provision contract including the APPEA's MoU: Mutual Aid agreement
	Source Control c) Access to SFRT Equipment	Review – Contract / Agreement	Annually (when drilling activity is occurring)	To confirm access to SFRT equipment for source control operations	Review to confirm access to SFRT equipment through • AMOSC SFRT participant contract • Oceaneering contract
	Source Control d) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for source control operations	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels for source control (capping stack and SFRT) operations
	Source Control e) Access to Source Control Emergency Response Personnel	Desktop Exercise	Annually (when drilling activity is occurring)	To check arrangements for access to Well Control Specialists as per Source Control Planning and Response Guideline DR-00-OZ-20001	Confirmation (email) from WWC that listed Well Control specialists can be made available and will be mobilized within 72 hours of a notification
	Source Control f) Testing of Santos Source Control Planning and Response Guideline DR-00-OZ-20001	Desktop Exercise	Annually	Testing of key arrangements in the Santos Source Control Planning and Response Guideline DR-00-OZ-20001	Validate key arrangements in Santos Source Control Planning and Response Guideline DR-00-OZ-20001
	Source Control g) Vessel Fuel Tank Rupture - SOPEP	Review - SOPEP	Prior to vessel arrival in field	To confirm that each vessel within the field has an approved SOPEP in place	Review to confirm approved SOPEP in place for vessels

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
2.	**Monitor and Evaluate**				
	Monitor and Evaluate - Vessel Surveillance a) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for surveillance	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels
	Monitor and Evaluate - Aerial Surveillance a) Access to aircrafts	Review – Contract / Agreement	Annually	To confirm access to aircrafts for surveillance	Review to confirm Master Service Agreements (MSAs) with aircraft providers to gain access to aircrafts for surveillance
	Monitor and Evaluate - Aerial Surveillance b) Access to trained aerial observers	Review – Contract / Agreement	Annually	To confirm access to trained aerial observers	Review to confirm access to trained aerial observers through; • Trained Santos personnel or • AMOSC Participant Member Contract or • OSRL Associate Member Contract
	Monitor and Evaluate - Unmanned Aerial Vehicles (UAV) a) Access to UAV providers	Review – Contract / Agreement	Annually	To confirm access to UAV providers	Review to confirm access to UAV providers through; • AMOSC Participant Member Contract or • OSRL Associate Member Contract
	Monitor and Evaluate - Fauna observations a) Maintain a list of air charter companies that could provide fauna observation services	Review – List of air charter companies for fauna observations	Annually	To confirm that a list of air charter companies that could provide fauna observation services is maintained	Review to confirm that a list of air charter companies that could provide fauna observation services is maintained
	Monitor and Evaluate – Tracking Buoys a) Access to Tracking Buoys	Review – Contract / Agreement	Prior to activity commencement	To confirm access to tracking buoys	Review to confirm access to Santos owned Tracking Buoys
	Monitor and Evaluate - Tracking Buoys b) Response readiness	Communication/Tracking software Test	6-monthly	To confirm response readiness for Tracking buoys	Tracking Buoys pass functional test as per operational instructions
	Monitor and Evaluate - Oil Spill Modelling a) Access to oil spill modelling service provider	Review – Contract / Agreement	Annually	To confirm access to emergency response oil spill modelling services	Review to confirm access to emergency oil spill modelling services through maintenance of service provision contract

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	Monitor and Evaluate - Satellite Imagery a) Access to Satellite Imagery service provider	Review – Contract / Agreement	Annually	To confirm access to satellite imagery services	Review to confirm access to satellite imagery services through; • AMOSC Participant Member Contract or • OSRL Associate Member Contract
	Monitor and Evaluate	Desktop Exercise	Annually	To confirm access to a range of Monitor & Evaluate options to ensure situational awareness for IMT	• Access to vessel and aerial platforms for surveillance confirmed. • Availability of trained aerial observers from day 2 confirmed through internal or external resources • Spill modelling delivered to IMT within 2 hrs of request to service provider • Availability of Tracking Buoy for deployment confirmed by onsite team • Satellite imagery acquisition and timelines confirmed by the service provider upon notification
3.	**Containment and Recovery**				
	Containment & Recovery a) Access to offshore containment Booms	Review – Contract / Agreement	Annually	To confirm access to offshore containment booms	Review to confirm access to offshore containment booms through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract
	Containment & Recovery b) Access to offshore recovery devices	Review – Contract / Agreement	Annually	To confirm access to offshore recovery devices	Review to confirm access to offshore recovery devices through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract
	Containment & Recovery c) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for containment and recovery operations	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels for containment and recovery operations
	Containment & Recovery d) Access to trained responders	Review – Contract / Agreement	Annually	To confirm access to trained responders	Review to confirm access to trained responders through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
					• Access to National Plan resources through AMSA
	Containment & Recovery	Desktop Exercise	Annually	To test activation procedure to access containment and recovery equipment and trained responders from external arrangements and service providers To confirm access to containment recovery equipment and trained responders from external arrangements and service providers	Emails confirming access to containment and recovery equipment and trained responders through external arrangements and service providers and activation procedures.
	Santos' Vessel Containment and Recovery system - response readiness	Deployment Exercise	Annually	To confirm response readiness for Santos vessel-based Containment and Recovery system	Vessel Containment and Recovery successfully deployed as per Operational Instructions.
4.	**Mechanical Dispersion**				
	Mechanical Dispersion a) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for mechanical dispersion	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels
5.	**Dispersant Application**				
	Dispersant Application a) Access to Dispersants	Review – Contract / Agreement	Annually	To confirm access to dispersants	Review to confirm access to dispersants through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • OSRL Global Dispersant Stockpile (GDS) Supplementary Agreement • Access to National Plan resources through AMSA
	Dispersant Application b) Access to Dispersant Vessel Spray System	Review – Contract / Agreement	Annually	To confirm access to Dispersant vessel spray systems	Review to confirm access to vessel spray systems through; Santos' equipment • AMOSC Participant Member Contract • OSRL Associate Member Contract
	Dispersant Application	Review – Contract / Agreement	Annually	To confirm access to Aerial Dispersant Application System	Review to confirm access to Aerial Dispersant Application systems through;

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	c) Access to Aerial Dispersant Application System				• AMOSC FWAD Contract • OSRL Associate Member Contract
	Dispersant Application d) Access to subsea dispersant injection equipment	Review – Contract / Agreement	Annually	To confirm access to Subsea Dispersant Injection equipment	Review to confirm access to subsea Dispersant Injection equipment through AMOSC SFRT participant contract
	Dispersant Application e) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for dispersant operations	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels for dispersant operations
	Dispersant Application f) Santos' Vessel Dispersant Spray System – Response Readiness	Deployment Exercise	Annually	To confirm response readiness for vessel dispersant spray system	Vessel Dispersant Spray system successfully deployed as per operational instructions
	Dispersant Application g) Logistics arrangement for GDS dispersant stockpile mobilization for a Level 3 oil spill incident	Desktop Exercise	Annually	To confirm GDS dispersant stockpiles can be mobilized in the event of a Level 3 incident	Confirm mobilization time frames as per Dispersant Logistics Plan
	Dispersant Application	Desktop Exercise	Annually	To test activation procedure to access dispersants and application systems from external arrangements and service providers To confirm access to dispersants and application systems from external arrangements and service providers	Emails confirming access to dispersants and application systems from service providers/external arrangements
6.	**Shoreline Protection and Deflection**				
	Shoreline Deflection & Protection a) Access to shoreline deflection & protection equipment	Review – Contract / Agreement	Annually	To confirm access to shoreline deflection and protection equipment	Review to confirm access to shoreline deflection and protection equipment through the following; Santos' equipment • AMOSC Participant Member Contract

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
					• OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Shoreline Deflection & Protection b) Access to trained responders	Review – Contract / Agreement	Annually	To confirm access to trained responders	Review to confirm access to trained responders through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Shoreline Deflection & Protection c) Access to shallow draft vessels	Review – List of shallow draft vessel providers	Annually	To confirm access to shallow draft vessels to support shoreline deflection & protection	Review to confirm access to shallow draft vessel providers
	Shoreline Deflection & Protection d) Santos' shoreline deflection and protection equipment	Deployment Exercise	Annually	To confirm response readiness for Santos' shoreline deflection and protection equipment	• Shoreline deflection and protection booms and recovery devices (disc/brush skimmers) deployed successfully as per operational instructions • Shoreline Equipment Maintenance schedules recorded in SAP
	Shoreline Deflection & Protection	Desktop Exercise	Annually	To test activation procedure to access shoreline deflection and protection equipment and trained responders from external arrangements and service providers To confirm access to shoreline deflection and protection equipment and personnel from external arrangements and service providers	• Emails confirming access to shoreline deflection and protection equipment and trained responders through external arrangements and service providers
7.	**Shoreline Clean-up**				
	Shoreline Clean up a) Access to shoreline clean up equipment	Review – Contract / Agreement	Annually	To confirm access to shoreline clean-up equipment	Review to confirm access to shoreline clean-up equipment through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	Shoreline Clean up b) Access to trained responders	Review – Contract / Agreement	Annually	To confirm access to trained responders	Review to confirm access to trained responders through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Shoreline Clean up c) Access to labour hire	Review – Contract / Agreement	Annually	To confirm access to labour hire	Review to confirm access to labour hire through maintenance of contract with labour hire provider
	Shoreline Clean up	Desktop Exercise	Annually	To test activation procedure to access shoreline clean-up equipment and personnel from external arrangements and service providers To confirm access to shoreline clean-up equipment and personnel from external arrangements and service providers To confirm coordination with DoT to implement shoreline clean-up plans	• Emails confirming access to shoreline clean-up equipment and personnel confirmed through internal and external arrangements/service providers to meet these requirements
	Shoreline Clean up	DoT Joint Exercise	Every 2 years; The exercise will be coordinated by DoT and will be dependent on DoT's interest and availability. Santos will express interest for a joint exercise with DoT	To test coordination with DoT to implement shoreline clean-up plan To test collective response arrangements between Santos and DoT for a Level 2/3 oil spill incident impacting State waters	• IMT interface established between Santos and DoT IMT established to jointly manage the shoreline clean-up activities as identified for the exercise scenario • Shoreline response plan jointly developed by Santos and DoT • Equipment and personnel required identified and implemented through collective response arrangements between Santos and DoT
8.	**Oiled Wildlife Response**				
	Oiled Wildlife Response a) Access to OWR equipment	Review – Contract / Agreement	Annually	To confirm access to OWR equipment	Contract review to confirm access to OWR equipment through the following; • AMOSC Participant Member Contract

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
					• OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Oiled Wildlife Response b) Access to OWR personnel	Review – Contract / Agreement	Annually	To confirm access to OWR personnel	Contract review to confirm access to OWR personnel through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Santos personnel
	Oiled Wildlife Response c) Reconnaissance and sample collection	Deployment Exercise	Annually	To confirm readiness for oiled wildlife reconnaissance and sample collection	Oiled wildlife reconnaissance and sample collection successfully conducted as per operational instructions (Santos oiled wildlife sample collection protocol)
	Oiled Wildlife Response	Desktop Exercise	Annually	To confirm activation procedure for OWR services with external service providers To confirm access to OWR equipment from external arrangements To confirm access to OWR personnel through a combination of internal and external resources	• Emails from service providers confirming OWR equipment availability. • Access to OWR personnel confirmed through a combination of internal and external resources
9.	**Waste Management**				
	Waste Management a) Access to personnel, equipment, and vehicles through Waste Service Provider	Review – Contract / Agreement	Annually	To confirm access to personnel, equipment, and vehicles for oil spill waste management	Contract review to confirm access to personnel, equipment, and vehicles for oil spill waste management
	Waste Management	Desktop Exercise	Annually	To confirm activation procedure for oil spill waste management services	Confirmation email from service provider on personnel, equipment, and vehicles for oil spill waste management within 24hrs of notification
10.	**Operational and Scientific Monitoring**				
	OSM a) Access to specialist monitoring equipment	Review – Contract / Agreement	Annually	To confirm access to specialist monitoring equipment	OSM Services Provider contract review to confirm access to specialist monitoring equipment

Santos

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	OSM b) Access to specialist monitoring personnel	Review – Contract / Agreement	Annually	To confirm access to specialist monitoring personnel	OSM Services Provider contract review to confirm access to specialist monitoring personnel
	OSM -Shoreline Clean-up Assessment a) Access to trained Shoreline Cleanup and Assessment Technique (SCAT) personnel	Review – Contract / Agreement	Annually	To confirm access to trained SCAT personnel	Review to confirm access to trained SCAT personnel through; • AMOSC Participant Member Contract • OSRL Associate Member Contract / OSRL OSM Contract • TRG Arrangements
	OSM – Oil Sampling a) Access to Oil Sampling Kit	Equipment Check	Annually	To confirm access to Oil Sampling Kit	Review to confirm access to Oil Sampling Kit. Kits to be fully stocked, maintained in good condition and the contents reviewed for adequacy.
	OSM – Oil Sampling b) Access to Rapid Assessment Team (RAT) kit(s)	Equipment Check	Annually	To confirm access to RAT kits	Review to confirm access to RAT kits (pursuant to site-specific first strike response plan). Kits to be fully stocked, maintained in good condition and the contents reviewed for adequacy.
	OSM – Dispersant Efficacy Testing a) Access to Dispersant Efficacy Field Test Kit	Equipment Check	Annually	To confirm access to Dispersant Efficacy Field Test Kit	Review to confirm access to Dispersant Efficacy Field Test Kit
	OSM - Water Quality Assessment a) Santos Rapid Assessment Team (RAT) – Response Readiness	Deployment Exercise	Annually	To confirm response readiness for Rapid Assessment Teams	Rapid Assessment Team successfully deployed as per operational instructions (pursuant to site-specific first strike response plan)
	OSM – Monthly Capability Reports	Review	Once per month	To confirm receival of the MSP's monthly capability report To confirm monthly capability report is in accordance with OSM services contract	Review monthly capability report each month and record when approved
	OSM	Desktop Exercise	Annually	To confirm activation procedure for OSM services To confirm access to personnel and equipment	Confirmation email from OSM service provider on the notification and activation procedures Confirmation email from OSM services provider on OSM personnel and equipment available

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
11.	**IMT**				
	Incident Management Team a) Access to trained IMT personnel	Review – Contract / Agreement	Annually	To confirm access to trained IMT personnel	Review to confirm access to IMT personnel through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA • TRG Arrangements
	Incident Management Team	Desktop Exercise - Availability Test for IMT	Annually	To confirm appropriate Santos's personnel to fill the IMT roles outlined in the OPEP	Each role listed can be filled by appropriately qualified staff and reporting hierarchy understood
	Incident Management Team	Level 2/3 IMT exercise	Annually	To confirm the response capability and capacity for Santos IMT To confirm external capability and capacity arrangements for IMT	• IAP is completed for the operational period and approved by the Incident Commander • An operational NEBA is undertaken for the operational period of the incident by the IMT • External arrangements tested and successfully integrated with IMT
12.	**Others**				
	Others - Communications Testing a) Communications channels in place and functioning	Desktop Exercise	Required for every approved OPEP. When response arrangements have changed. Annually	To test all communication and notification processes to service providers and regulatory agencies defined within the OPEP	• Notification and communication processes tested successfully for: – Service providers – Regulatory agencies • Communications Test Report completed • Corrections updated within the Santos Incident Response Telephone Directory (SO-00-ZF-00025.020)
	Others - AMOSC	Audit	Every 2 years	To confirm SLA including equipment readiness and personnel competency	• Audit confirms the OSRO's ability to meet the SLA/contract commitments • Records indicate appropriate maintenance program confirming equipment readiness • Personnel competency is assessed to be up to date

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	Others - OSRL	Audit	Every 2 years	To confirm SLA including equipment readiness and personnel competency	• Audit confirms the OSRO's ability to meet the SLA/contract commitments • Records indicate appropriate maintenance program confirming equipment readiness • Personnel competency is assessed to be up to date
	Others - Santos Oil Spill Response Equipment Inventory Register	Equipment Check	Minimum every 6 months, or when change is communicated from equipment custodians.	To confirm the status of available oil spill response equipment	Review to confirm access to oil spill response equipment on the register