



Puffin Wells Abandonment Environment Plan Summary

20 June 2014



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This Environment Plan summary has been prepared to comply with Regulations 11(3) and 11(4) of the Offshore Petroleum & Greenhouse Gas (Environment) Regulations 2009.

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Revision History

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A	20/06/14	Re-issued to NOPSEMA	Giulio Pinzone	Phil Harrick	Ian Cashion 
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1. Introduction

Sinopec Oil and Gas Australia (Puffin) Pty Ltd (SOGA), a wholly-owned subsidiary of China Petrochemical Corporation (Sinopec), as Titleholder of Petroleum Production Licence AC/L6 in the Ashmore and Cartier Area of the Bonaparte Basin, operates the Puffin Development (Figure 1).

SOGA proposes to plug and abandon (P&A) the currently shut-in Puffin-7 and -8 wells and the suspended Puffin-5, -9, -10, -11 and -12 wells. This activity is anticipated to commence in the third quarter (Q3) of 2014 subject to contracting a suitable semi-submersible drill rig, and is herein referred to as the Puffin Wells Abandonment project (hereafter referred to as 'the project').

Production from Puffin North East commenced in October 2007 through the use of a Floating Production, Storage and Offtake (FPSO) vessel, the *Front Puffin*, tied to the Puffin-7 and -8 subsea wells (Figure 2). These wells required gas lift to produce oil. This vessel departed the field in July 2009 after having produced 2.2 MMbbls of crude oil (and ceased production in May 2009).

The non-production phase (NPP) of the Puffin Field has been managed under a care and maintenance regime since July 2009. Previously operated by Oceaneering Services Australia (OSA) on behalf of SOGA, OSA's facility operations division was purchased by Upstream Production Solutions Pty Ltd (UPS) in February 2014 who continues as the current Operator.

UPS is the registered Operator of the Puffin Field Subsea Equipment under the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 and manages the facility in accordance with a NOPSEMA-accepted Facility Safety Case. SOGA is the registered Operator under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E)).

An Integrated Project Management Team has been created in association with AGR Petroleum Services (AGR) for this project. AGR has drilled numerous offshore exploration wells in Australia and brings substantial local experience to the team. They provide resources to assist with designing the program, contracting a drilling rig and third-party service providers, obtaining environmental and safety regulatory approvals, and day-to-day management during the program.

2. Proponent

China Petrochemical Corporation (Sinopec Group) is a large petroleum and petrochemical enterprise group established in July 1998 on the basis of the former China Petrochemical Corporation. Headquartered in Beijing, Sinopec Group has a registered capital of RMB 182 billion (~\$AUD32 billion).

Sinopec Group's key business activities include industrial investment and investment management, the exploration, production, storage and transportation, and marketing of oil and natural gas, oil refining, the wholesale of gasoline, kerosene and diesel, the production, marketing, storage, transportation of petrochemicals and other chemical products, the design, construction and installation of petroleum and petrochemical engineering projects and other associated activities.

Additional information about the Sinopec Group can be obtained from its website at: <http://english.sinopec.com>.

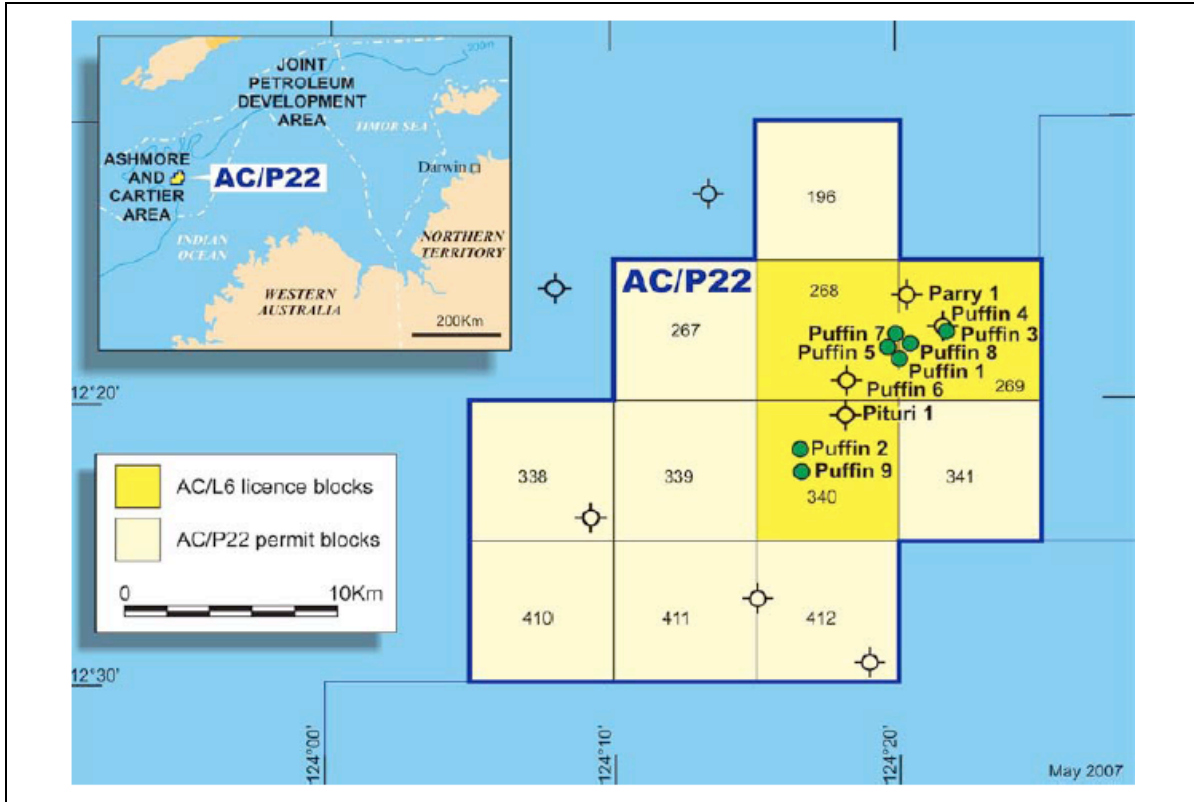


Figure 1. Location of the Puffin Field

3. Location

The Puffin Field is located in AC/L6 and covers an area of approximately 900 km² in the Vulcan sub-basin in water depths ranging from 75 to 104 m. The Puffin Field is remote from environmental sensitivities and coastal populations, as listed in Table 1.

Table 1. Distances to key features in the region

Locality	Distance from Puffin Field*
<i>Environmental features</i>	
Barracouta Shoal (submerged feature)	42 km (23 nm) to the southwest
Vulcan Shoal (submerged feature)	57 km (31 nm) to the south
Goeree Shoal (submerged feature)	65 km (35 nm) to the south
Cartier Island	88 km (47 nm) to the west
Eugene McDermott Shoal (submerged feature)	90 km (49 nm) to the southeast
Hibernia Reef	110 km (59 nm) to the northwest
Ashmore islands and reef	129 km (69 nm) to the west
Heywood Shoal (submerged feature)	134 km (72 nm) to the south
Echuca Shoal (submerged feature)	185 km (100 nm) to the southwest
Gale Bank (submerged feature)	194 km (104 nm) to the east

Baldwin Bank (submerged feature)	208 km (112 nm) to the east-southeast
Bassett-Smith Shoal (submerged feature)	190 km (102 nm) to the east-southeast
Penguin Shoal (submerged feature)	199 km (107 nm) to the east-southeast
Browse Island	220 km (119 nm) to the east
Nearest Australian mainland	255 km (137 nm) to the southeast
<i>Commonwealth Marine Reserves</i>	
Cartier Island	81 km (44 nm) to the southwest
Ashmore Reef	116 km (63 nm) to the west
Kimberley	~212 km (115 nm) to the south
<i>Coastal towns</i>	
Darwin	706 km (380 nm) to the east
Broome	670 km (361 nm) to the southeast
<i>Other oil and gas infrastructure</i>	
Montara unmanned wellhead platform	48 km (26 nm) to the south
Crux FPSO (proposed only)	74 km (40 nm) to the south-southeast
Prelude Floating LNG (under construction)	197 km (96 nm) to the south-southeast
Ichthys wellhead platform (in development)	217 km (117 nm) to the south-southeast

* Using Puffin-7 as the point of measurement.

4. Activity Description

4.1 Current Status

Production from the Puffin Field ceased when the Front Puffin FPSO departed the field in July 2009. Since that time, the field has been in a non-production care and maintenance mode.

Subsequent modification works were carried out in late 2010 to remove the Submerged Turret Production (STP) buoy and mooring system and lay down the dynamic flowlines and umbilicals on the seabed secured with clump weights. A surface buoy (with functional navigational light) is situated above the subsea infrastructure to mark its presence. The remaining infrastructure on the seabed consists of:

- Disconnected flexible risers (x3);
- Riser bases (x3);
- Flowline jumpers (containing inhibited water) for oil and gas lift and hydraulic umbilicals between the Pipeline End Manifold (PLEM) and riser bases and between the PLEM and the well xmas trees (SSTs);
- PLEM (containing inhibited water);
- Anchors (x 6) (with anchor lines disconnected and laying on the seabed); and
- The Puffin-7 and -8 SSTs and associated wellheads, guide bases and posts. Tree isolations are in place, valves are closed and marine growth covers are in place on the tree and production pod.
- The Puffin-5, -9, -10, -11 and -12 wellheads and guide bases and posts.

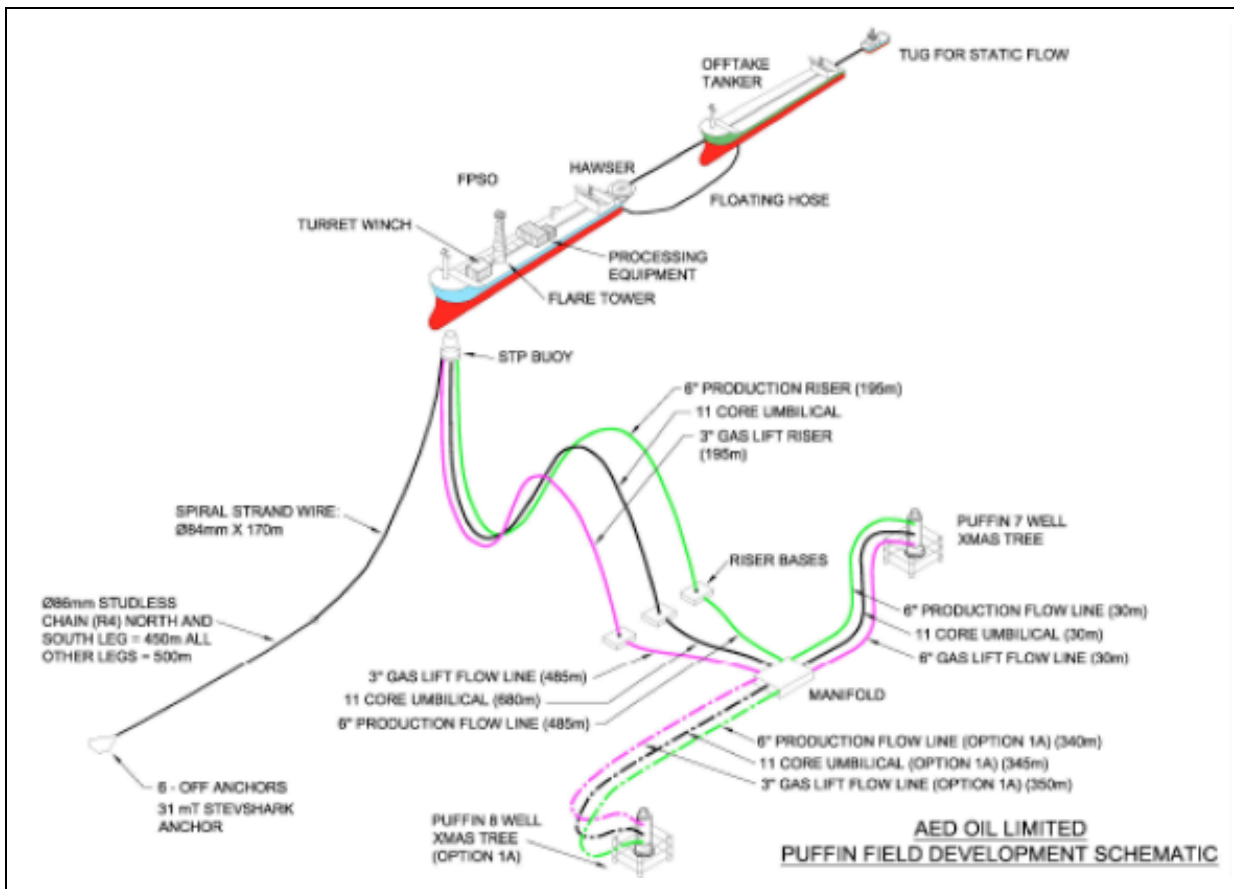


Figure 2. The original layout of the Puffin Field Development

4.1.1 Production Wells

The Puffin-7 and -8 production wells are currently shut-in with all control/safety valving closed and the control umbilicals de-pressured and isolated.

4.1.2 Suspended Wells

The Puffin-5, -9, -10, -11 and -12 wells were temporarily suspended with wellheads in place but no subsea tree or completion string. The wells were suspended in accordance with the Designated Authority-accepted Well Operations Management Plans (WOMP) submitted at the time and / or an approved suspension plan. It is important to note that there is no connection between the above suspended wells and the Puffin Production Facilities.

4.1.3 Abandoned Wells

Puffin-1, -2, -3, -4 and -6 were permanently abandoned in accordance with good oilfield practices of the time (1972, 1974, 1975, 1988 and 2001 respectively) and the Designated Authority approved abandonment plan. They have no infrastructure remaining above the seabed. As abandoned wells, they are not considered part of the scope of the EP.

4.1.4 Other Infrastructure

The PLEM, flowlines and jumpers are filled and capped with inhibited water, which comprises fresh water and 'Multitreat 650' dosed at 1,000 ppm. This is a corrosion inhibitor that acts to maintain the structural integrity of the infrastructure by preventing corrosion.



Multitreat 650 is a 'Silver' rated CHARM product. The hydraulic umbilical lines are filled and capped with Transaqua HT hydraulic fluid, which is a 'D' rated non-CHARM product.

4.2 P&A Program for Production Wells

SOGA has contracted a semi-submersible MODU to undertake the drilling campaign in 3Q14. The MODU is currently drilling in Australian waters.

Two Anchor Handling, Tug and Supply (AHTS) vessels will support the MODU for the duration of the P&A programme. The AHTS vessels will tow the MODU to and from location, supply fresh water, food, fuel and bulk drilling materials, transport waste generated from the MODU back to shore and monitor the 500-m radius Petroleum Safety Zone (PSZ) around the MODU. The vessels will work out of the Port of Darwin.

In addition to the AHTS vessels that will be used at various stages of the project, a Construction Support Vessel (CSV) will be used ahead of the MODU mobilisation to site to clean the wellheads prior to the well abandonment activities commencing. The CSV will be mobilised to the Puffin field location up to three months prior to the MODU arriving on site, notionally in May/June 2014.

The vessel will be used to facilitate wellhead cleaning. A work-class ROV will be deployed from the CSV to clean all the wellheads of accumulated marine growth and sediment in readiness for their connection to the MODU drilling tools. This will involve the use of high-pressure blasting and/or scouring tools to remove marine growth and sediment. Doing so ensures that drilling tools can make secure connections with the subsea equipment. The CSV will also remove the Production Pod (PP) from Puffin-7 and -8 subsea trees and install Workover Pods (WOPs). Following cleaning activities, the CSV will deploy the ROV to

- Sever the production umbilical at the subsea trees with a cutting tool;
- Sever 6" (154 mm) production flowline at subsea tree with cutting tool; and
- Sever 3" (77 mm) gas lift flowline at subsea tree with cutting tool.

This work will take in the order of several days. In addition to the above work, guide posts will be re-attached to Puffin-9 to facilitate the abandonment process on this well.

Once the MODU is anchored on location, an ROV will be deployed from the MODU to conduct an as-found seabed infrastructure survey. The following sequence of work will be followed for the project:

- Position MODU over well and set anchors;
- Installation and function test of Intervention and Workover Control System (IWOCS) to control Subsea Tree hydraulic functions;
- Recover Tree Cap to surface using the Tree Cap Running Tool (TCRT) run on drill pipe;
- Re-enter SST via dual bore workover riser;
- Bullhead (the pumping of kill-weight mud downhole) brine into production tubing;
- Install deep set plug to isolate reservoir (wireline operation);
- Punch production tubing to establish communication with production annulus;
- Circulate tubing and annulus to brine and release annulus gas via IWOCS through surface bleed-back package;
- Install deep cement plugs in production tubing and 'A' Annulus;
- Sever production tubing and recover approximately 200 ft to surface;

- Recover Subsea Tree to surface or 'wet store' on seabed (for retrieval during full field decommissioning);
- Recover Tubing Hanger to surface;
- Install surface cement plug;
- Sever wellhead;
- Recover Flowline Support Base (FSB) and wellhead to surface or 'wet store' on the seabed; and
- Pull anchors and move MODU of location.

All wells will be permanently P&A in compliance with the NOPSEMA-accepted WOMP with regards to barrier standards, well abandonment criteria and barrier verifications. The WOMP has been developed in accordance with the *Guidelines on the Suspension and Abandonment of Wells* (Oil and Gas UK, Issue 4, July 2012).

4.3 P&A Program for Suspended Wells

The P&A of the Puffin-5, -9, -10, -11 and -12 wells have no subsea trees or completions installed. Each well consists of permanent guide base (PGB), 30" (762 mm) casing, 18³/₄" (463 mm) wellhead swaged down to 13³/₈" (340 mm) casing. The well barriers consist of a deep-set and shallow (environmental) cement plugs.

While none of these wells (with the exception of Puffin-12) contain cement in the 9⁵/₈" and 13³/₈" annulus opposite the internal surface 9⁵/₈" cement plug, no permeable (water) zones or hydrocarbon-bearing zones were encountered in the 12¹/₄" open hole section above existing tops of cement. Therefore, annular cement in the 9⁵/₈" x 13³/₈" casing near surface is not necessary.

SOGA will permanently P&A these suspended wells in accordance with a NOPSEMA-accepted WOMP and the *Guidelines on the Suspension and Abandonment of Wells* (Oil and Gas UK, Issue 4, July 2012).

The abandonment process for these wells involves a similar process to as that described in Section 4.2, without the presence of a SST or production tubing. A summary of the abandonment procedures is provided below:

- Position MODU over well and set anchors;
- Run BOP and marine riser on to wellhead;
- Pressure test the BOP;
- Drill out existing surface cement plugs where required;
- Install deep set cement plugs where required;
- Sever wellhead and retrieve, or 'wet park' on seabed for later recovery;
- Install surface cement plug where required; and
- Pull anchors and move MODU.

4.4 Support Vessels

Two AHTS vessels will support the MODU for the duration of the P&A programme. The AHTS vessels will fulfil the following functions:

- Tow the MODU to and from location;
- Supply fresh water, food, fuel and bulk drilling materials and equipment;

- Transport waste generated from the MODU back to shore;
- Monitor the 500-m radius PSZ around the MODU and intercept errant vessels; and
- Assist in emergency response functions.

The Port of Darwin will be used as the supply base, approximately 27 hours steaming time from the Puffin Field. Supply operations will be undertaken on an as required basis.

In addition to the two AHTS vessels that will support the MODU during the project, it is possible that a third AHTS vessel will enter the field prior to the MODU to pre-lay the MODU anchors. If this option proceeds, it is likely to take place a few weeks ahead of MODU mobilisation to the field.

A fourth AHTS vessel (or equivalent) is being sought by SOGA to facilitate the management of tight MODU deck space during the abandonment program and to ensure that supplies to the MODU using one of the two AHTS vessels are not interrupted, with one vessel required to be on standby with the MODU at all times and the other vessel carrying out anchor handling duties as the rig moves to each well location.

In addition to the AHTS vessels that will be used at various stages of the project, a Construction Support Vessel (CSV) will be used ahead of the MODU mobilisation to site to clean the wellheads and sever the production and gas lift flowlines and SST control umbilicals prior to the well abandonment project commencing. The nominated CSV is the *Skandi Hawk*, which was built in 2012 and is operated by DOF.

4.5 Field Decommissioning

Abandonment of the Puffin wells does not constitute decommissioning. Full field decommissioning will be undertaken at a future point in time and will be subject to a separate EP. Decommissioning will involve the removal of items 'wet stored' on the seabed during the P&A programme, along with flowlines, risers, PLEMs and anchors. Options for decommissioning, including full removal and disposal to shore or creation of artificial reef in shallower waters, will be fully explored.

5. Stakeholder Consultation

Consultation between SOGA and relevant persons has been ongoing since initial field production planning, including the following phases:

- Puffin Development planning - June to September 2005;
- Puffin Development pre-installation – February to March 2007;
- Additional drilling and geotechnical work – March 2008;
- Additional drilling – 2009;
- Cessation of production – 2010; and
- Non-production operations – December 2013.

Consultation with regards to this project commenced in August 2013 with over 25 government, commercial and recreational fishing, environment and industry organisations. This consultation yielded no material concerns. Consultation with agencies involved in oil spill response have been engaged to ensure that the Oil Spill Contingency Plan (OSCP) reflects current agency arrangements.

6. Receiving Environment

6.1 Physical Environment

Climate. The region has a tropical climate with hot and humid summers and warm winters. There are two distinct seasons: the 'wet' usually from October to March and the 'dry' for the remainder of the year. The median annual rainfall is 1,209 mm. Over 75% of the average annual rainfall events from January to March are associated with thunderstorms and tropical lows or cyclones. From October to April maximum ambient air temperatures average over 35°C while overnight minima are typically 24°C. Winters are milder, with July average maximum and minimum temperatures being 32°C and 14.0°C respectively. Mean sea temperature ranges are reported to range between 22-27°C in winter and 26-30°C during summer.

Winds. The two main broad scale influences are the band of high pressure known as the sub-tropical ridge well to the south, and the monsoon that delivers moist air from the warm tropical waters to the north. During the warmer months, a heat-trough forms over the inland Kimberley. These combine to produce a general south-easterly wind regime for much of the year. Tropical cyclones capable of strong winds, high seas and heavy rain can be experienced during the months from November to April, but are most common in January and February.

Ocean currents. Ocean currents in the Timor Province bioregion are dominated by the southward-flowing warm surface Indonesian Throughflow that flows from the tropics to the waters of southwest Western Australia and dominates most of the water column. The Indonesian Flowthrough generally flows westwards and its strength varies seasonally in conjunction with the Northwest Monsoon. During the wet season (December–March), monsoon winds push some of the waters of the current eastwards, extending as far as the Gulf of Carpentaria. At the end of the Northwest monsoon (March–April), the pressure gradient is released, which releases a south-westerly flow of water across the shelf during autumn and winter, known as the Holloway Current.

Bathymetry. The Puffin Development is located on the outer slope of the Australian continental shelf in water depths of 60-100 m. Scattered along the outer shelf are sea mounds, shoals and occasional islands. Bathymetric data for the licence area indicates that the topography is predominantly flat and featureless.

Seabed. There is no distinct shelf break within the Timor Province. Instead, there is a smooth transition from the outer shelf to the upper continental slope. The seabed sediments of the region comprise bio-clastic, calcareous and organogenic sediments that were deposited by relatively slow and uniform sedimentation rates. Within the Timor Province, carbonate sands dominate the sediments of the outer shelf and slope of this bioregion and mud content typically increases with water depth. The seabed of the permit area is characterised by fine to coarse sand with small zones of gravel/coral fragments.

6.2 Biological Environment

Benthic Invertebrates. Most of the benthic systems of the Timor Province are detritus-based and reliant upon deposit feeding infauna and epifauna (animals that live on the seafloor or burrow into its sediments, such as nematodes, polychaete worms, shelled molluscs and a variety of crustaceans).

Site surveys performed along the subsea flowline route and at the STP anchoring sites indicate that the seabed is a soft-substratum habitat, characterised by fine-coarse sand with numerous zones of coarse sediment interpreted as gravel and coral fragments. At these water depths, light is limiting near the seafloor and inhibits plant growth.

While no benthic surveys have been performed at the Puffin Development site, benthic survey data available from the Challis site (located 80 km northeast of Puffin in similar soft-sediment types) is considered to be indicative of the benthic habitat at the Puffin development site (i.e., clayey silts to sand-sized marine carbonate sediments). At Challis, while abundances of most taxa were low, there was high variability in species. Polychaetes and crustaceans were the most abundant taxa. Empty trochid shells and ostracod carapaces were abundant in the samples. Polychaetes in this deep water, soft sediment habitat are likely to have planktonic larvae and wide geographic ranges.

Plankton. Big Bank Shoals plankton surveys have found that zooplankton assemblages in the top 20 m of water column to be diverse and abundant at most sites in the region. Planktonic crustaceans that feed on phytoplankton were the most common taxa found. Previous studies undertaken found that zooplankton abundance increased during July-August and was related to the coastal upwellings caused by the southeast monsoonal winds. These studies indicate that zooplankton biomass was in the range 65-155 mg/m³ which, although high for Australian continental shelf waters, is still relatively low in a world context.

Fish. The Timor Province bioregion has 408 fish species, 64 (15%) of which are endemic, and 198 of which occur in water depths greater than 200 m. Most fish have tropical distributions and are well distributed throughout the Indo-West Pacific region. Key fish species targeted in the region by commercial fisheries include goldband snapper (*Pristipomoides multidens*), Spanish mackerel (*Scomberomorus commerson*), rankin cod (*Epinephelus multinotatus*), red emperor (*Lutjanus sebae*), pink snapper (*Pagrus auratus*), blacktip shark (*Carcharhinus melanopterus*) and sandbar shark (*C. plumbeus*). The whale shark (*Rhincodon typus*), shortfin mako shark (*Isurus oxyrinchus*) and longfin mako shark (*I. paucus*) are EPBC Act-listed migratory species that are likely to pass through the waters of the development area.

Marine Mammals. Dolphins are relatively common in the region. Species known to occur in the region are the bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*) and Indo-pacific humpback dolphins (*Sousa chinensis*). A number of whale species, including the short-finned pilot whale (*Globicephala macrorhynchus*), Bryde's whale (*Balaenoptera edeni*) and humpback whale (*Megaptera novaeangliae*) also occur in the region, the most commonly sighted of these being the humpback whale. This species migrates between the Antarctic waters (feeding) and the Kimberly region of Western Australia (breeding and calving).

The peak of their northerly migration to the Camden Sound region occurs around mid- to late July to early August, while the southerly return migration peaks from late August to early September. Humpback whales use the Kimberley coast (Camden Sound and King Sound in particular) as calving grounds between June and mid-November (200 km southwest of the proposed drill site). The highest numbers of cows/calf pairs are present from mid-August to mid-September.

Reptiles. Six species of marine turtles are listed as threatened and migratory under the EPBC Act and may traverse the licence area. Four of these species, the green, flatback, loggerhead, and hawksbill turtles, nest on sandy shore sites south of the region around the Dampier Archipelago, Montebello Islands, Lowendal Islands, Murion Islands, Barrow Island, Airlie Island, Thevenard Island, other nearby coastal islands and the Exmouth region. All species except the green turtle have mid-shelf or deep water habitats, with the green turtle (*Chelonia mydas*) generally found in water depths less than 20 m. Green turtles are known to nest at Ashmore, Cartier and Browse islands.

The main turtle nesting and hatching period occurs from November to March with a peak in December. Hatchlings emerge 6 to 8 weeks after females have nested. There are no biologically important areas in or around AC/L6 for any of these turtle species.

Twenty-five species of sea snakes are recorded in WA waters (12 of these potentially occurring in and around AC/L6), however little is known of the distribution of individual species, population sizes or aspects of their ecology. Sea snakes are widespread through tropical waters in offshore and near-shore habitats.

Coral. Coral reef habitat occurs to the southwest (Scott, Seringapatam, Cartier), west (Ashmore Reef) and the southeast and east (various shoals) of AC/L6, but not within it. These reef systems are regionally important for their high biodiversity, and support a high biomass of fish species, including tropical reef fish, small pelagic fish such as parrotfish and groupers, and larger species such as trevally, coral trout, emperors, snappers, dolphinfish, marlin and sailfish, as well as crustaceans.

Avifauna. Seabirds may transit the area on occasion, but the deep waters and distance to emergent land make it unlikely that the area comprises important habitat to birds.

Birds that occur year round or as seasonal visitors in the region, such as petrels and shearwaters, are likely to be common in and around the project area. Surveys of pelagic seabird populations in the northeast Indian Ocean reveal that foraging seabirds were typically clumped in areas adjacent to islands. This may be because islands provide shelter, while anomalies in surface water concentrate food seasonally. Foraging groups typically comprise sooty terns (*Sterna fuscata*), wedge-tailed shearwaters (*Puffinus pacificus*) and the occasional frigatebird (*Fregata* spp.). The most commonly encountered seabirds that were not foraging were wedge-tailed shearwaters and Bulwer's petrels (*Bulweria bulweria*); however, these two species were only recorded in low densities.

Ashmore Reef and Cartier Island are important breeding areas for the brown booby (*Sula leucogaster*), which breeds from February to October, and the red-footed booby (*S. sula*), which breeds year round with most egg laying between April and June. The great frigatebird (*Fregatea minor*) is reported to be a widespread pelagic seabird, with breeding take place on numerous tropical islands, including in small numbers on Ashmore Reef. The lesser frigatebird (*F. ariel*) is also known to breed on Ashmore Reef and Cartier Island (from March to September).

EPBC Act-listed avifauna that may occur in and around AC/L6 includes the streaked shearwater (*Puffinus leucomelas*), which occurs all along the Australian northwest, northern and eastern coasts, though is scarcer in northern and eastern waters. The Australian lesser noddy (*Anous tenuirostris melanops*) usually occupies coral-limestone islands densely fringed with white mangrove (*Avicennia marina*) in which it roosts at night.

6.3 Socio-economic Environment

Settlements. The AC/L6 licence area is located approximately 550 km north of the township of Derby. Derby has a population of 4,500 people, with about 50% of the population being Aboriginal. A high proportion of the population is employed in State and Commonwealth departments (e.g., Main Roads, health services and the water authority). Derby is also the main base for the Royal Flying Doctor Services (RFDS) in the Kimberley.

Shipping. The ports of northwest Australia (Onslow, Dampier, Cape Lambert, Port Hedland and Broome) handle large tonnages of iron ore and petroleum exports, resulting in very busy shipping routes through the area. The closest port to AC/L6 is Broome, which is the largest deep-water port in the Kimberley region. It supports livestock export, offshore oil and gas exploration supply vessels, pearling, cruise liners, fishing charters and general cargo. In 2006-07, 80% of the imported tonnage to the port related to the servicing the petroleum exploration and development industry. Consultation with the Australian Maritime Safety Authority (AMSA) indicates that there will be local vessel traffic encountered south of the Puffin subsea equipment, with most traffic travelling in an east-west direction along the Osborn Passage located 50 km to the south.

Petroleum Exploration and Production. The Timor Sea is a highly prospective petroleum region and includes world-scale project such as the Bayu-Undan Gas Project and the Evans Shoals and Sunrise gas fields.

Within the Bonaparte Basin, 68 petroleum accumulations have been identified and commercial production has occurred from 11 of these discoveries. The estimated gas reserves measure in excess of 566 billion cubic meters (bcm³) in the Bonaparte Basin and 538 bcm³ in the Browse Basin off Western Australia.

Estimated oil reserves remaining within the Timor Sea are at least 167.73 million cubic metres of oil, condensate and liquid petroleum gas (LPG). While there is currently no petroleum production from the offshore Browse Basin, several projects are in development (Ichthys and Browse LNG).

Commercial Fisheries. Several WA and Commonwealth-managed fisheries have jurisdiction to fish in the licence area. Western Australian-managed fisheries that may fish the area include the North Coast Demersal Scalefish Fishery (Area 2, Zone C), the North Coast Prawn Fishery (Kimberley Prawn) and Northern Prawn Fishery (Broome), though little to no fishing actually occurs in the licence area. Commonwealth-managed fisheries that may fish the area include the Western Tuna and Billfish fishery and Northwest Slope Trawl fisheries, with little to no fishing recorded around the licence area between 2005 and 2011.

Traditional Fisheries. The Puffin Field lies to the east of the 'MoU Box' (the Memorandum of Understanding between Australia and the Republic of Indonesia in 1974), which allows traditional Indonesian fishing within Australian waters. This access was granted in recognition of the long history of traditional Indonesian fishing in the area. The MoU allows fishing within the reefs of Cartier Island, Scott Reef, Seringapatam Reef and Browse Island. The MoU defines traditional fisherman as fishers who have traditionally taken fish and sedentary organisms in Australian waters using traditional fishing methods and non-motorised sailing vessels. Target species include trochus, sea cucumber, abalone, green snail, sponges, molluscs and finfish, including sharks. While the amount of fish taken is unknown, it is thought to be substantial.

Conservation Values and Sensitivities. The conservation of natural and anthropological heritage in Commonwealth marine areas is grouped into the categories outlined in Table 2, with the nearest sites to AC/L6 listed and briefly described.

Table 2. Conservation areas in the vicinity of the Puffin Field

Heritage Place	Commonwealth Marine Reserve (CMR)	World Heritage List	Commonwealth Heritage List	National Heritage List	Ramsar Wetland site
Ashmore Reef	Yes	No	Yes	No	Yes
Cartier Island	Yes	No	No	No	No
Hibernia Reef	No	No	No	No	No

The Ashmore Reef CMR is located approximately 115 km west of the Puffin Field at its nearest boundary and includes two extensive lagoons, shifting sand flats and cays, seagrass meadows and a large reef flat covering 239 km². The reserve was originally proclaimed in 1983.

Ashmore Reef consists of an atoll-like structure with three low, vegetated islands, numerous banks of shifting sand and two large lagoon areas. The three islands located within the lagoon — West Island (32 ha), East Island (16 ha), and Middle Island (13 ha) — are mostly flat, being composed of coarse sand with a few areas of exposed beach rock and limestone outcrops. All of the islands are vegetated with shrubs and herbs. Ashmore Reef is as an important breeding site for seabirds such as the common noddy (*Anous stolidus*), sooty tern

(*Sterna fuscata*), bridled tern (*S. anaethetus*) and crested tern (*S. bergii*). In all, 20 species are known to breed on the islands. The reef also provides habitat to a diverse marine fauna that includes dugong (*Dugong dugon*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), and an important and unique population of sea snake species – three of which are endemic to the area.

The Cartier Island CMR covers an area of 172 km² and was originally proclaimed as the Cartier Island Marine Reserve in June 2000. The CMR covers an area within a 4 nm radius of the centre of the island. The island is an un-vegetated sand cay surrounded by mature reef flats; it sits at the centre of a reef platform that rises steeply from the seabed. The island supports large populations of nesting turtles.

The conservation values of the CMR include its international significance for its abundance and diversity of sea snakes, a large and significant feeding population of green, hawksbill and loggerhead turtles, and it supports some of the most important seabird rookeries on the North West Shelf.

Although part of the same group as Ashmore Reef and Cartier Island, Hibernia Reef does not form part of the Ashmore Reef & Cartier Island External Territory of Australia. Situated 42 km northeast of Ashmore Reef and 62 km northwest of Cartier Island, Hibernia Reef consists of an approximately oval-shaped reef that tapers to a point on the western side. The reef has no permanent land, but large areas of the reef can become exposed at low tide. The reef covers an area of 11.5 km².

Ecologically rich shoals are found around the Puffin Field, mostly within a 250 km radius to the south and east. These are mostly poorly described but are known to support light-dependent species such as macroalgae and coral, in turn supporting diverse fish populations.

Maritime Archaeological Heritage. The Australian National Shipwreck Database lists 4 shipwrecks registered within the vicinity of Browse Island, but none in the AC/L6 licence area. There are no historic shipwreck protected zones in the licence area. The Western Australian Shipwrecks Database indicates there are no shipwrecks in or near the AC/L6 licence, with the nearest wreck being the *Yarra* at Scott Reef.

7. Environmental Impact Assessment

The known and potential environmental impacts and risks resulting from the project are outlined in detail in the EP. Table 3 provides a summary of the environmental impact assessment (EIA) and environmental risk assessment (ERA) and mitigation measures that are in place, which have been assessed to be As Low As Reasonably Practicable (ALARP).

For this EP, the EIA has been applied to *planned* events – events that will occur and will impact the environment and are therefore not subject to an assessment of likelihood of occurrence.

On the other hand, ERA refers to a process where hazards associated with an activity are assessed for their likelihood of occurrence and their consequence in terms of their potential impact on the environment (physical, biological, and socio-economic) at a defined location and specified period of time. For this EP, the ERA has been applied to *unplanned* events – events that may or may not occur and may or may not impact the environment, and are therefore subject to an assessment of likelihood of occurrence.

Table 3. Summary environmental impact assessment for the Puffin wells abandonment project

Hazard	Potential consequences	Key avoidance, mitigation & management measures	Residual risk ranking
<i>PLANNED ACTIVITIES</i>			
Seabed disturbance (MODU anchoring, wellhead cleaning)	Temporary and localised loss of benthic habitat.	<ul style="list-style-type: none"> • Anchors deployed to meet seabed conditions outlined in the mooring analysis. • Monitoring of anchor cross-tensioning while on location. • AHTS vessels will not anchor (unless in case of emergency). 	Insignificant
Underwater noise	Temporary physiological impacts on sensitive fauna, such as cetaceans.	<ul style="list-style-type: none"> • Engines will be maintained in accordance with planned maintenance systems. 	Insignificant
Artificial lighting	Attractant to fauna, temporary increase in predation rates on fauna attracted to lights.	<ul style="list-style-type: none"> • Lighting managed in accordance with maritime safety standards. 	Insignificant
Atmospheric emissions	Temporary and localised reduction in air quality.	<ul style="list-style-type: none"> • Marine-grade (low sulphur) diesel used. • Engines, machinery and flare burner maintained in accordance with planned maintenance systems. • No waste incineration will take place. 	Insignificant
Drilling brine fluids discharges	Temporary and localised elevation in surface water salinity and turbidity.	<ul style="list-style-type: none"> • Use of low-toxicity ('D'/'E' [non-CHARM] or 'Gold'/'Silver' [CHARM] OCNS-rated) brine and WBM chemical additives. 	Insignificant
Cement and cement cuttings discharges	Temporary and localised reduction in water quality. Localised smothering of benthic habitat and fauna.	<ul style="list-style-type: none"> • Use of low-toxicity ('D'/'E' [non-CHARM] or 'Gold'/'Silver' [CHARM] OCNS-rated) cement additives. • No bulk batch discharge of mixed cement will take place. • Cementing operations will be monitored by ROV to ensure excess cement is not discharged to the seabed. 	Insignificant
Cooling and reverse osmosis brine water discharges	Temporary and localised elevation in surface water temperature and salinity.	<ul style="list-style-type: none"> • Cooling water and reverse osmosis systems maintained in accordance with the planned maintenance system. 	Insignificant
Sewage, grey water and putrescible waste	Temporary and localised reduction in water quality. Modification of fauna feeding	<ul style="list-style-type: none"> • MARPOL-approved sewage treatment plant fitted. • Sewage treatment plant is maintained in accordance with the planned maintenance 	Insignificant

discharge	patterns.	<p>system.</p> <ul style="list-style-type: none"> No discharge of sewage and putrescible waste within 12 nm of land. Putrescible waste macerated to < 25 mm in size prior to discharge. Non-food galley wastes will be bagged and returned to shore for disposal. 	
Deck and bilge water drainage	Temporary and localised reduction in water quality.	<ul style="list-style-type: none"> Oil-in-water (OIW) treatment system in place on the bilge water tank, with no discharge over 15 ppm oil-in-water. Oil captured from the OIW treatment system will be transferred to shore for disposal. Chemical storage and fuel transfer areas are bunded. Valid International Oil Pollution Prevention Certificate in place. Spills to decks cleaned immediately. Shipboard Oil Pollution Equipment Plan (SOPEP) kits available on board for rapid clean-up response. 	Insignificant
Hazardous and non-hazardous solid waste discharges	Temporary and localised reduction in water quality.	<ul style="list-style-type: none"> MODU Waste Management Plan in place: <ul style="list-style-type: none"> Crew inducted into procedures. Material Safety Data Sheet (MSDS) register maintained. Solid non-putrescible wastes bagged and sent ashore for disposal. All bins secured to deck and covered with lids. Only small volumes of chemicals kept on board. Waste streams will be sorted on board according to shore-based recycling capabilities. Garbage Record Book will be maintained. MODU loading and unloading procedure is in place and implemented by the crane operators. ROV is deployed to search for (and retrieve, where possible) any large non-buoyant dropped objects. Use of licensed shore-based waste contractors. 	Insignificant
Temporary storage of well equipment on seabed	<p>Temporary loss of benthic habitat over a small area of seabed.</p> <p>Localised hydrocarbon</p>	<ul style="list-style-type: none"> SSTs are flushed clean with brine prior to recovery or wet storing on the seabed. Wet stored equipment is placed on the seabed within the envelope of the Puffin Field petroleum safety zone. 	

	contamination from interior surfaces of production equipment. Potential for wet parked equipment to act as artificial substrate for marine growth, changing the spatial distribution of fish.		
UNPLANNED ACTIVITIES			
Introduction of invasive marine species	Establishment of foreign species to open ocean and/or seabed, competing with and displacing native species.	<ul style="list-style-type: none"> • MODU and AHTS vessels will have anti-fouling paint applied to hulls and internal niches. • MODU and AHTS vessels will be cleared to enter Australian waters (if previously mobilised from outside Australian waters) in accordance with the Australian Ballast Water Management Requirements. 	Inconsequential
Interactions with third-party vessels	Temporary loss of fishing grounds. Snagging risk. Disruption to commercial activities.	<ul style="list-style-type: none"> • The location of the MODU is communicated to other marine users by: <ul style="list-style-type: none"> ○ The gazettal of the 500-m radius petroleum safety zone (PSZ). ○ Consultation flyers distributed to SOGA prior to the well abandonment program. ○ Notice to Mariners. ○ AusCoast Warnings. • The MODU will use anti-collision monitoring equipment. • The AHTS vessels will monitor the MODU's PSZ to ensure no unauthorised third-party vessel interaction with the MODU. 	Inconsequential
Liquid drop out during flaring	Temporary decrease in surface water quality.	<ul style="list-style-type: none"> • Annulus gas bleed offs will be initiated during suitable weather conditions as defined by pre-start checks. • An 'Evergreen' burner (or equivalent high-efficiency burner) will be used to reduce liquid drop out rates. • The early flow will be directed to separator tanks to remove liquids prior to flaring. • A flare watch will be used for immediate system shutdown in the event of a dropout being observed. 	Inconsequential
Presence of Naturally Occurring	Radiation of project personnel. Discharge of	<ul style="list-style-type: none"> • Safely disposed of NORM-contaminated scale in accordance with the Puffin Field NORM Management Plan. 	Inconsequential

Radioactive Material (NORMs)	NORM scale and sand to the sea.		
Diesel spill (vessel-to-vessel collision)	Injury or death to marine fauna through ingestion or contact. Temporary decrease in water quality. Habitat damage in the case of shoreline contact.	<ul style="list-style-type: none"> As per row above. Oil Spill Contingency Plan (OSCP) and Emergency Response Plan (ERP) in place and ready for implementation. Diesel spill will be promptly reported internally and externally. Diesel spill modelling indicates no shoreline contact (above 10 µm threshold) in the event of a 123 m³ spill volume. Operational monitoring will take place in accordance with the OSCP to support the spill response and characterise environmental impacts. 	Inconsequential
Crude oil release	Injury or death to marine fauna through ingestion or contact. Temporary decrease in water quality.	<ul style="list-style-type: none"> The physical integrity of the dual-bore riser will remain intact at all times. Puffin-7 and -8 are physically isolated from the reservoir. Puffin-5 and Puffin-9-12 wells are physically isolated from the environment. The Guidelines on the Suspension and Abandonment of Wells (Oil and Gas UK, July 2012) are implemented in the design and execution of the well abandonment project to prevent future hydrocarbon leaks from the wells. 	Inconsequential

Hierarchy of consequence and risk

Consequence (planned events)	Risk (unplanned events)
Catastrophic	Critical
Major	Significant
Moderate	Tolerable
Minor	Inconsequential
Insignificant	

8. Hydrocarbon Spill Preparedness and Response

The Puffin Well Abandonment OSCP is the primary reference document to be used in the event of a diesel spill or crude oil release. The OSCP contains information on the proposed response strategies.

In the case of a diesel spill or crude oil release, SOGA has determined that the most appropriate strategy for responding to the spill is to allow it to naturally disperse and biodegrade, while monitoring and evaluating the situation. This is primarily because there are no shorelines, reefs or other environmental sensitivities that are likely to be contacted (as determined by spill modelling), due to the very small release volumes. This is supported by a Net Environmental Benefit Analysis (NEBA) that assesses the strengths and weaknesses of each response strategy for both hydrocarbon types. The Australian Marine Oil Spill Centre (AMOSC) has endorsed this response strategy.

The first priorities in the event of a diesel or crude oil spill are to:

- Ensure the safety of all personnel; and
- Contain and where possible stop the source of the spill.

9. Implementation Strategy

SOGA retains full and ultimate responsibility as the Titleholder of the AC/L6 licence area and is responsible for ensuring that the activities associated with the Puffin Wells Abandonment project are implemented in accordance with the performance objectives outlined in the EP. SOGA has entered into an agreement with AGR to provide the following ongoing services for this project:

- Design and construct the abandonment programme is in accordance with industry best practice and legislated standards;
- Obtain all regulatory approvals;
- Ensure that contractors have appropriate equipment to implement the required activities and have appropriate systems in place to ensure that these activities are undertaken in accordance with all legislative requirements;
- Provide day-to-day direction of work in accordance with the approved WOMP and the accepted EP; and
- Implement the Integrated Management System (IMS) (i.e., health, safety and environment) and support (resource) services.

9.1 Environmental Management System

AGR's IMS is certified to ISO 14001 and is supported by a set of Management System Standards (MSS) that provide a framework for the management of quality, health, safety and environment throughout AGR's operations.

9.2 Key Roles and Responsibilities

The MODU contractor will have the day-to-day control and management of the MODU and reports via the AGR Drilling Supervisor to the SOGA Operations Manager and ultimately to the SOGA Head of Upstream Assets on the execution of the project. The MODU Offshore Installation Manager (OIM) has over-riding authority and responsibility to make decisions with respect to environment protection and pollution prevention and to request assistance in an emergency as required.

A detailed list of the environmental roles and responsibilities of personnel are outlined in the EP.

9.3 Training and Awareness

In order to ensure that operations meet all business and statutory requirements, the correct selection, placement, training and ongoing assessment of employees is managed, and sufficient resources are provided.

All MODU-based personnel will attend a campaign-specific induction prior to the commencement of duties (either shore-based or on board the MODU). The induction will include EP awareness and compliance aspects, including:

- Environmental regulatory requirements;
- Environmental sensitivities and key risks;
- Key environmental management actions, including but not limited to:

- Waste segregation, containment and disposal;
- Housekeeping and spill prevention;
- Spill preparedness and response; and
- Environmental incident reporting.

The AGR Drilling Supervisor is responsible for ensuring personnel receive this induction prior to the commencement of their work.

9.4 Emergency Response and Preparedness

The MODU emergency organisation and contingency plans are established in accordance with recognised industry practice, including the APPEA Guidelines of Offshore Emergency Management (1999).

AGR requires that a project-specific ERP is developed for each drilling project. This is to ensure that AGR, the MODU Contractor, UPS, SOGA and all associated personnel respond to all emergencies (unplanned events) in a controlled and comprehensive manner, prioritising actions to ensure human safety, and communicating with internal and external stakeholders as appropriate. AGR has developed a Puffin Well Abandonment Bridging ERP that interfaces with the MODU contractor emergency procedures.

Both the MODU contractor emergency procedures and the Puffin Well Abandonment Bridging ERP will be subject to a desktop review and exercise as a part of planning for the Puffin Well Abandonment project.

The SOGA Emergency Management Manual (EMM) details the SOGA response to assist and ensure effective and timely management of emergencies on or affecting SOGA interests, to cover the location-specific reporting requirements and specific emergency response plans.

9.5 Incident Recording, Reporting and Investigation

SOGA and AGR have internal requirements for the recording and reporting of incidents. There are legal obligations under the OPGGS(E) to report incidents to NOPSEMA within a specified time period. These requirements are outlined in detail in the EP.

All breaches of the EP are considered non-compliances. Non-compliances may be identified during an audit, inspection, crew observation or as a consequence of an incident. These will be investigated in accordance with the AGR IMS. Following an investigation, remedial actions will be developed to prevent recurrence and tracked to completion.

All incidents on the MODU (and within the 500-m radius safety exclusion zone) will be reported and investigated in accordance with the MODU's procedures. The MODU OIM will lead the initial incident investigation on-board, in line with the MODU Incident and Accident Investigation procedures. The AGR Drilling Supervisor will participate in any investigation to ensure the requirements of their respective management systems are met.

9.6 Performance Monitoring and Improvement

A Performance Monitoring and Improvement system will be in place for the Puffin Wells Abandonment Programme to monitor performance in order to assess the effectiveness of the HSE Management System in controlling environmental impacts and risks and developing a positive HSE culture.

AGR has formal audit arrangements that will be applied throughout the project. AGR shall monitor the MODU's HSE performance with performance measured, reported and reviewed through daily, weekly and monthly performance reports, and a daily conference call between the MODU (OIM, Safety Advisor and AGR Drilling Supervisor in attendance) and office-based project personnel. See also Section 9.8 for a description of inspection activities.

9.7 Environmental Monitoring

SOGA will maintain a quantitative record of emissions and discharges as required under Regulation 14(7) of the OPGGS(E) as outlined in Table 4. Results will be reported in the Annual EP performance report submitted to NOPSEMA.

Table 4. Puffin Wells Abandonment project environmental monitoring program

Risk	Monitoring requirement	Frequency
Planned activities		
Seabed disturbance	<ul style="list-style-type: none"> Pre- and post-drilling ROV survey. 	Pre-spud and at completion.
Atmospheric discharges	<ul style="list-style-type: none"> Fuel use. 	Daily.
Drilling brine and WBM discharges	<ul style="list-style-type: none"> Volume. 	Daily.
Deck and bilge water discharges	<ul style="list-style-type: none"> OWS automatically monitors OIW content when switched on. 	When bilge tanks requires emptying.
Waste disposal	<ul style="list-style-type: none"> Weight/volume of wastes sent ashore. ROV inspection for dropped objects. 	On transfer to AHTS vessels. At completion.
Wet parking of well equipment	<ul style="list-style-type: none"> Post-abandonment ROV survey for location of wet-parked equipment. 	Once before departure of the MODU.
Unplanned activities		
Diesel spill	<ul style="list-style-type: none"> Monitoring in line with the OSCP. 	In the event of a spill.
Reservoir release	<ul style="list-style-type: none"> Monitoring in line with the OSCP. 	In the event of a spill.

9.8 Audit and Review

AGR assesses operating performance to ensure that the processes and systems adopted are effective in meeting AGR policies and objectives, and statutory HSEQ Performance requirements. AGR's HSE Audits and Management Review Procedure details how audits are scheduled and executed to ensure that project operations meet the requirements of the AGR IMS.

Inspections will be undertaken by the AGR Drilling Supervisor on the MODU to ensure that standards and equipment reflect the requirements of the EP and that performance standards are met. Any departures from the performance standards will be documented as a non-compliance (see Section 9.5) with follow-up actions recorded, communicated to affected parties and remedial actions implemented and tracked to closure. These results will be included with the Annual EP Performance Report submitted to NOPSEMA.



10. Further Information

For further information about the Puffin Wells Abandonment project, please contact:

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