



Shell Development (Australia) Pty Ltd
(ACN 14 009 663 576)

Environment Plan AC/RL9

Summary



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1. Introduction

Shell Development (Australia) Pty Ltd (SDA) proposes to drill a single exploration well, Auriga West-1 (Auriga), in the Petroleum Permit Area AC/RL9. In addition, SDA also proposes to permanently abandon three previously drilled and suspended wells (Crux 2 (sidetrack 1), 3 and 4) in AC/RL9. AC/RL9 retention licence is located in the northern Browse Basin, 200 km offshore northwest the Kimberley coast and 600 km north-north east of Broome (Figure 1).

The activities will be undertaken using a Mobile Offshore Drilling Unit (Rig), which will be supported by offshore vessels working from Shell's main supply base in Broome.

This Environment Plan summary has been prepared as per the requirements of Regulation 11 of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations, 2009*.

2. Location of the Activity

SDA proposes to drill the Auriga well and permanently abandon three suspended Crux wells, in AC/RL9. The wells, lie in 150-200 m water depth in Commonwealth marine waters, 200 km north of the Kimberley coast and 600 km north-north east of Broome (Figure 1).

The Auriga well will be drilled to a total vertical depth of ~3,963 m. The planned Auriga well location and coordinates for the Crux wells are shown in table 1:

Table 1: Well locations

Well	Easting (GDA94; MGA Zone51S)	Northing (GDA94; MGA Zone51S)
Auriga West-1	661180	8565080
Crux-2 ST1	659235	8570082
Crux -3	656982	8566947
Crux -4	658428	8566313


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Figure 1: Location of Permit Area AC/RL9

3. Description of the Activity

Drilling of the Auriga well and the permanent abandonment of the three existing Crux wells is scheduled to commence in March 2015 at the earliest, and is planned to take approximately 3-6 months to complete. The plan to permanently abandon the Crux wells, includes removal of the wellheads currently in place.

Aviation support and crew changes to the Drilling Rig will be conducted through either Mungalalu Truscott Airbase or Broome International Airport via Lombadina Airport. Due to the long flying distance involved (2 hours flying time one way); helicopter refuelling on the Rig will be required. Access to Truscott is via Darwin International Airport.

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Once on location the Rig will be supported by two to four vessels. At least one of the vessels is planned to remain with the Rig, while the other vessels travel to and from the supply base to service the Rig.

The Rig will likely be moored using up to 8 anchors at each location, with each anchor occupying about 25 m² of seabed (~200 m² in total). The main sources of noise during drilling are typically from drilling machinery on the Rig, vessels and choppers as well as vertical seismic profiling.

For the Auriga well, the uppermost hole sections will be drilled using a water based mud (WBM) system while the lower hole sections will be drilled using a synthetic based mud (SBM) system. SBM has been selected to drill the deeper and more technically challenging portion of the Auriga well.

All three Crux plug and abandonment operations are planned to use a WBM system, which includes using top quality cement followed by the installation of adequate amount cement abandonment plugs inside the casings to seal off the wells.

4. Description of the Environment


4.1. Physical

The Petroleum Permit Area AC/RL9 is located on the Sahul Shelf; a broad, shallow platform off the north west coast of Australia in the Timor Sea. The shelf ranges in width from 300 km to 500 km and is believed to be a recently drowned portion of the Australian continent. Water depths on the Sahul Shelf range are mostly less the 200 m, dropping to 3,000 m in the Timor trough, which runs parallel to the island of Timor.

The most sensitive seabed features in the broader Browse Basin are the coral reefs and islands that occur in the region. The closest of these features are the Barracouta, Vulcan and Eugene McDermott shoals, located ~90, 18 and 13 km respectively from AC/RL9. Due to the distance of the Auriga well from these features, it is not anticipated that these sensitivities will be affected by any planned impacts associated with drilling the Auriga well.

AC/RL9 is situated in the tropics and experiences a monsoonal climate with two predominant seasons. The Australian Northern monsoon generally occurs between December and March. It is associated with the inflow of moist, west to north-westerly winds into the monsoon trough, producing convective cloud and heavy rainfall over northern Australia. During the cooler months, the subtropical ridge that lies over continental Australia drives stable and persistent easterly quadrant winds over the region.

The large-scale ocean circulation on the north west shelf is linked with major Southeast Indian Ocean and Indo-Pacific current regimes, such as the Indonesian Pacific Through Flow, which contributes to the westward flowing South Equatorial Current (between 8° and 15°S latitude) and floods the north west shelf with relatively warm, low-salinity water. Wind-induced currents occur due to local wind forcing at the surface and are most pronounced during tropical cyclones.

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4.2. Biological

In the general region of AC/RL9, at 150-200 m depth, there is little evidence of hard substrates and extensive epibenthic communities. Thus, with little sea floor topography, such areas offered minimal habitat diversity or niches to occupy. Specifically, the absence of hard substrate is considered a limiting factor for the recruitment of epibenthic organisms.

The Department of Environment's Environment Protection Biodiversity Conservation (EPBC) Protected Matters Database does not list any Threatened Ecological Communities occurring in the marine environment. The database lists eleven Threatened Species that potentially occur within AC/RL9.

The EPBC Protected Matters Database also lists twenty one species covered by the migratory provisions of the EPBC Act 1999 that may occur within AC/RL9. Migratory species that may occur within the AC/RL9 permit area include seven cetacean species, five bird species, six reptile species and three fish / shark species. The permit area does not contain any recognised feeding, breeding or aggregation areas for these species, hence large numbers of these species are not anticipated to be encountered during these activities.

4.3. Marine Reserves


A search of the EPBC Protected Matters Database identified that AC/RL9 is located within the North West Marine Region, however it does not overlap with any Commonwealth Marine Reserves. In the worst-case spill scenario of a blow-out there are a number of Marine Reserves lie within the zone of potential impact. These include: Ashmore Reef, Cartier Island, Argo-Rowley Terrace, Oceanic Shoals, Mermaid Reef, and the Kimberley Commonwealth Marine Reserve.

4.4. Socio-Economic Environment

The project area overlaps with a variety of commercial fishing management areas. Commercial fisheries include tuna and tropical finfish, particularly emperor, snapper and cod. WA State managed commercial fisheries permitted to operate within AC/RL9 include Mackerel Fishery, Northern Dermersal Scale Fishery, Northern Shark Fisheries, Pearl Oyster Fishery, Kimberley Prawn Managed Fishery, West Coast Deep Sea Crustacean (Interim) Fishery, Specimen Shell Managed Fishery and Marine Aquarium Fish Managed Fishery. Commonwealth managed commercial fisheries, which are permitted to operate within the Permit area include Southern Blue Fin Tuna Fishery, Western Skipjack Fishery, Western Tuna and Billfish Fishery, North West Slope Trawl Fishery and Northern Prawn.

Currently, there are no known recreational fishing activities within AC/RL9 as it is considered too far from shore to be accessed by recreational fishermen. Even at relatively high speed (30 km/hour), it would take at least fifteen hours for a recreational boat to reach the project area from the nearest port of Broome.

Oil exploration activities in the Timor Sea commenced in the late 1960s. Since this time numerous wells have been drilled throughout the region. Specifically, petroleum exploration has been active in the Browse Basin since the 1980s, with several commercial discoveries since that time. The closest facility is the Montara production Floating Production Storage and Offloading (FPSO) facility is 33 km to the North of the facility.

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None of the major commercial shipping routes through the Timor Sea pass through AC/RL9. The nearest major shipping lane to the west of the permit area is over 300 km away. The nearest shipping lane to the north of the project area is approximately 50 km distant. Given the distances between the proposed activity and shipping lanes, the drilling activity will likely pose minimal navigational risk to commercial shipping.

There are no known sites of Aboriginal cultural significance within AC/RL9. Given that the location of the permit is more than 200 km from the mainland, it is highly unlikely that the area is used for hunting or fishing by Australian Aboriginal people. There are no islands or land within the proposed drilling area and therefore there are no land based Aboriginal heritage sites.

Information on historic shipwrecks is maintained in the National Shipwrecks database, a searchable database of Australian shipwrecks containing shipwreck records provided by the Australian State and Territory governments. A search of the database revealed no known shipwrecks within the permit area.

5. Management Approach

The Shell Commitment and Policy on Health, Safety, Security, Environment and Social Performance (HSSE and SP) applies across Shell globally and is designed to protect people and the environment.

Key features of the policy are:

- Systematic approach to HSSE and SP management designed to ensure compliance with the law and to achieve continuous performance improvement;
- Targets for improvement and measurement, appraisal and performance reporting;
- Requirement for contractors to manage HSSE and SP in line with this policy; and
- Effective engagement with neighbours and impacted communities.


All of Shell's operations comply with the Shell HSSE and SP Control Framework, a comprehensive corporate management framework, comprising a simplified set of mandatory standards applicable to every Shell Company, contractor and joint venture under Shell's operational control.

Within Shell, the HSSE and SP Control Framework requires people in HSSE Critical Positions to have their HSSE-MS competence assured. These people have to attain a set proficiency level in three competences: HSSE Lead; HSSE Prepare; and HSSE Apply. People in HSSE Critical Positions are responsible for the development and maintenance of effective barriers to prevent incidents.

This activity will be managed to comply with the relevant State and Commonwealth Acts and Regulations, industry standards and applicable international agreements.

The SDA Drilling Supervisor (DSV) is Shell's representative aboard the Rig. The DSV is responsible for ensuring the operational requirements of the EP are communicated to the Rig crew and implemented on a daily basis.

Shell has a program of audits that take place at pre-mobilisation and during the activity. An annual EP compliance audit will be undertaken to determine compliance with the requirements

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of this EP. The audit will assess and report against the established environmental objectives, standards and measurement criteria.

If any new or increased risks are identified during the activities, an assessment of the risk will be undertaken. If the risk is determined to be significant new or significantly increased risk, the associated activity will not continue until acceptance of the management approach to the new/changed risks has been provided and accepted by the Department of Environment and NOPSEMA.

All Environmental incidents and non-conformances are managed in accordance with the SDA HSSE Incident Reporting, Investigation and Follow Up Procedure that describes the process of reporting, classification, investigation, follow-up and close out.

Shell's overall environmental objective for the activity is to avoid or reduce environmental risks to as low as reasonably practicable. Specific objectives, standards and measurement criteria for each aspect of the survey that has the potential to cause adverse environmental impact have been identified. Environmental performance will be measured and reported against these standards and criteria as part of Shell's commitment to continuous improvement of environmental, health and safety performance.

Environmental Performance report will be submitted to NOPSEMA as required by *OPGGS (E) Regulations 2009*. This report will be submitted within 3 months of completion of the activity, given the activity is less than 1 year long, one report is deemed sufficient.


The Oil Spill Contingency Plan will be tested during the activity, to make all personnel aware of their personal responsibilities in these plans. Exercises are critical to ensure there is appropriate level of response readiness should there be an incident and is an important part of continually managing the risks associated with an oil spill to ALARP from a response readiness perspective.

An Implementation Strategy has been incorporated into the Environment Plan per the *OPGGS (E) Regulations 2009*. This includes:

- Measures, systems, practices to ensure environmental performance objectives and standards are met;
- Chain of Command;
- Measures to ensure workers are aware of their responsibilities;
- Monitoring and management;
- Records and reporting;
- Oil Spill Contingency Plan, and
- Consultation.

6. Environmental Hazards and Controls

A risk analysis has been undertaken for all aspects of operations, in accordance with the Shell HSSE and SP Control Framework and in line with the principles outlined in the Australian Standard AS/NZS ISO 31000:2009 Risk Management and HB 203:2006 Environmental Risk Management.

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The risks for each planned and unplanned event have been determined using a qualitative assessment process. The level of risk has been determined by assessing risk likelihood and consequence using the Shell Risk Assessment Matrix.

This is a 6 by 5 matrix that is used for qualitative assessments of risk and assists determination of appropriate controls and mitigation measures:

- The vertical axis represents increasing consequences (severity levels 0 to 5) in terms of harm to people, damage to assets, effect on the environment and impact on reputation with 5 having the greatest severity; and
- The horizontal axis represents increasing likelihood (levels A to E) of the consequence under consideration, with E having the greatest likelihood.

To demonstrate that risks are as low as reasonably practicable and at an acceptable level, all mitigation measures have been considered and where these measures are practical, they have been included.

Incidents with a consequence severity equal to or greater than level 3 (i.e. moderate to massive) are considered 'Reportable Incidents' in line with Regulation 26 of the *OPGGS (E) Regulations*. For this activity, based on the risk assessment, though the probability of occurrence is low, three possible events are considered to have a moderate or greater consequence, if they occur:

- Death or injury of a member of a threatened or migratory or cetacean species as a result of a collision with a vessel;
- A diesel spill resulting from a vessel to vessel collision; and
- Any spill resulting from a well blow out.


A summary of the key environmental hazards and control measures to be applied to the activities are shown in Appendix A. These are consistent with SDA and project-specific environmental objectives, standards and measurement criteria. All control measures associated with the hazards will be used to reduce environmental risk to ALARP and will be of an acceptable level.

7. Consultation

Shell has undertaken broad consultation with key stakeholders who have an interest in our activities in the Browse basin. Consultation for this activity is built upon extensive and ongoing engagement carried out for Shell's operated activity in the region, mainly the Prelude FLNG Project.

In the process of initially identifying and engaging with relevant persons, Shell considered relevant government agencies and persons or organisations whose functions, interests or activities may be affected by the activity. Stakeholders consulted include:

- Commonwealth government departments;
- Western Australia government departments;
- Northern Territory government departments;
- Broome and Kimberley community stakeholders;
- Broome local government agencies;

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- Commercial fishing industry associations; and
- Recreational fishing industry associations.

Prior to the submission of the Environment Plan, stakeholders were notified of our intent to undertake the activity and submit for environmental approval from NOPSEMA. Information provided included a location map and the expected commencement and duration of the activities. Engagement on the activity will continue throughout 2014/2015 leading up to and post the completion of the activity as appropriate. Shell has a communications plan in place to ensure stakeholders are kept informed of project progress and outcomes. Stakeholders are able to raise questions/concerns at any time via the following email address, which is posted on the Shell website: kelly.lamperd@shell.com or sda-exploration@shell.com.

Shell responded to feedback received from stakeholders listed above during the consultation period. Comments raised included a request by WA Department of Fisheries to contact all individual commercial fisheries licence holders that may be impacted by the activity. As a result Shell provided details of the activity to all individual licence holders identified by the WA Department of Fisheries.

No other concerns / queries were raised by stakeholders during the consultation process. Stakeholders have been and are currently able to raise their concerns via direct communication, primarily through Shell's dedicated Communications focal point (contact details below).

8. Contact Details

For further information about this activity, please contact the titleholders nominated liaison person:

Kelly Lamperd

Address: 2 Victoria Avenue, Perth, Western Australia, 6000

Tel: +61 (0) 8 9338 6000

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Hazard / Event	Potential Environmental Impact	Controls – Mitigation Measures
<i>Planned Activities- Rig and Vessels</i>		
Physical presence of the Rig	Disruption of commercial or recreational fishing or shipping activity.	A 'Notice to Mariners' advising of the presence of the Drilling Rig will be issued through the Australian Maritime Safety Authority (AMSA) prior to the commencement of the activity. Stakeholder consultation has been undertaken as appropriate so that they are aware of the activity and any concerns have been addressed.
Anchoring of the Rig	Smothering and disturbance of benthic communities.	The anchoring plan will identify suitable areas for anchors to be placed.
Noise generated by vessels/ Rig activities	Disruption to behaviour patterns of sensitive marine fauna from Drilling Rig operations and/ or noise generated by vessel movements.	Location of drilling in open ocean, well away from coastal environments and fauna migration routes. Routine drilling and vessel noise thoroughly studied and documented - below levels likely to cause physiological damage to marine fauna. Marine Mammal Observer present during Vertical Seismic Profiling operations. Adherence to EPBC Policy Statement 2.1 as required.
Discharge of deck drainage waste from the Rig and vessels	Localised and temporary acute toxic effects caused by contaminants in waste stream.	Deck spills cleaned up using adsorbents (spill kits) and/ or diverted to slops tanks. Potentially contaminated water drained to slops tanks and passed through the oil/ water separator prior to discharge at <15 ppm or stored onboard for onshore disposal (<i>MARPOL 73/78 Annex 1 – Regulation for the Prevention of Pollution by Oil from Ships under the Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i>).

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Hazard / Event	Potential Environmental Impact	Controls – Mitigation Measures
Discharge of sewage, food scraps and grey water from the Rig and vessels	Localised and temporary acute toxic effects caused by contaminants in waste stream (e.g. nutrient enrichment).	Food wastes, grey water, sewage treated in accordance with <i>MARPOL 73/78 Annex V – Regulation for the Prevention of Pollution by Garbage from Ships under the Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> . Sewage treated in accordance with <i>MARPOL 73/78 Annex IV – Regulation for the Prevention of Pollution by Sewage from Ships under the Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> .
Drill cuttings and bulk water based muds (WBM) discharge	Disturbance to benthic communities as a result of smothering and pelagic communities.	Sections drilled riserless with seawater/ prehydrated bentonite sweeps, cuttings deposited directly on seafloor minimising zone of impact and turbidity. WBM used for top sections, planned to be returned to surface using a Riserless Mud Recovery system and WBM cuttings directed across shale shakers to recover WBM for reuse prior to cuttings discharging to ocean. Fines sent to a settling pit to recover WBM prior to cuttings discharge. Drilling muds selected using chemical selection protocols. SBM potentially only used to drill bottom sections as technically required on Auriga well only. No bulk SBM discharged to ocean at any time throughout the duration of the activity. Synthetic Base Fluid on cuttings discharge within % specification limit.
Disposal of excess or contaminated cement	Impacts to benthic communities as a result of smothering and pelagic communities as a result of increased turbidity of cement disposal.	Cements meet chemical selection criteria. Unused additives returned to shore for reuse or disposal. Same high temperate cement blend will be used throughout the activity, minimising the volume of residual bulk cement to be mixed and discharged (for disposal) at the end of the well programme. Proactive maintenance system for all cement unit equipment.
Atmospheric emissions from fuel combustion	Reduction in air quality through combustion of liquid fuel.	Emissions (including the use of low sulphur diesel) will be compliant with <i>MARPOL 73/78 Annex VI – Regulation for the Prevention of Air Pollution from Ships</i> , enforced under the <i>Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> .

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Hazard / Event	Potential Environmental Impact	Controls – Mitigation Measures
Unplanned Impacts		
Vessel collision with marine life	Injury and/ or death of a cetacean or other protected fauna.	The permit area AC/RL9 is not nearby to known cetacean feeding or breeding areas and is distant to the humpback whale migration routes. Animals are expected to alter course away from slow-moving or stationary support vessels.
Sourcing of the Rig/ vessels with overseas last port of call that may be carrying non-native marine species	Introduction of exotic marine species via ballast water exchange or biofouling causing alteration to community composition and function, competition with indigenous species.	Support vessels sourced with an overseas last port of call will have had an anti-foul treatment within 12 months or their hulls inspected and cleaned, if required, before arrival in Australia. Australian Quarantine legislation will be met for vessels and Rig.
Accidental discharge of hazardous / non-hazardous solid wastes into the ocean	Reduction in habitat/ water quality, acute/ chronic toxic effect on marine organisms.	Shell and Contractor Garbage Management Plans developed to <i>MARPOL 73/78 Annex V – Regulation for the Prevention of Pollution by Garbage from Ships</i> and <i>Annex II– Regulation for the Prevention of Pollution by Noxious Liquid Substances in Bulk from Ships</i> and <i>Annex III– Regulation for the Prevention of Pollution by Harmful Substances Carried by Sea from Ships</i> under the <i>Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i>), and local requirements including: <ul style="list-style-type: none"> • a list of all hazardous substances planned to be used including MSDS, storage requirements, details of provider, Australian regulatory requirements for disposal and procedures for managing accidental discharges/ spills; • requirement that all wastes be tracked and logged, sent to shore for recycling or disposal in government approved waste disposal site; and • the Rig has dedicated storage area for containers and tanks that contain segregated maintenance waste. Shipboard Oil Pollution Emergency Plans (SOPEP)s and regulator accepted Oil Spill Contingency Plan. Stochastic oil spill modelling indicates surface spilt hydrocarbons have no probability of reaching shorelines or intertidal reefs in any spill scenario.

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Hazard / Event	Potential Environmental Impact	Controls – Mitigation Measures
Diesel or aviation fuel spill during Drilling Rig refuelling at sea	Potential loss of diesel or aviation fuel to the marine environment causing localised and temporary acute toxic effects and direct physical smothering of marine organisms.	<p>At sea refuelling will occur with:</p> <ul style="list-style-type: none"> strict adherence to refuelling procedures, reinforced hoses with dry break couplings and fail-safe fittings; operation will commence in daylight under normal conditions; Favourable wind and sea conditions as determined by the Master of the vessels; Fuel hoses changed annually and refuelling constantly observed by crew member in radio contact with Vessel Masters. Shipboard Oil Pollution Emergency Plans. <p>Recovery Measure: Regulator accepted Oil Spill Contingency Plan prior to activity commencement.</p> <p>Oil Spill Modelling indicates surface spilt hydrocarbons from a refuelling incident have no probability of reaching environmental sensitivities at levels above thresholds.</p>
Dirty Oil spill resulting from a collision between a vessel and the Rig	Potential acute/ chronic toxic effects and direct physical smothering of marine organisms.	<p>A 'Notice to Mariners' advising of the presence of the Rig will be issued through AMSA prior to the commencement of the activity. Ongoing communication with AFMA, and other commercial mariners such that that presence of the Rig and vessels widely communicated.</p> <p>A safety zone of 500 m radius around the drilling unit will be maintained at the well site. The Rig will be located in open waters with no navigation constraints and will be well lit at night and during times of poor visibility.</p> <p>Support vessels to be equipped with suitable navigational systems.</p> <p>Recovery Measure: Regulator accepted Oil Spill Contingency Plan prior to activity commencement.</p>

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Hazard / Event	Potential Environmental Impact	Controls – Mitigation Measures
Diesel spill resulting from a collision with another vessel	Potential acute/ chronic toxic effects and direct physical smothering of marine organisms.	<p>A 'Notice to Mariners' advising of the presence of the Drilling Rig will be issued through AMSA prior to the commencement of the activity. Communication with AFMA, and other commercial mariners such that that presence of vessels is widely communicated.</p> <p>Support vessels manned by competent crew.</p> <p>Support vessels routes are pre-determined and risk assessed.</p> <p>Vessels equipped with suitable navigation systems.</p> <p>Recovery Measure: Regulator accepted Oil Spill Contingency Plan prior to activity commencement.</p>
Loss of well control/ well blow-out	Potential loss of gas and condensate to the marine environment causing acute/chronic toxic and physical effect on marine organisms and habitats.	<p>Regulator accepted Well Operations Management Plan (WOMP) and drilling program meeting the following Shell requirements:</p> <ul style="list-style-type: none"> • Training; • Global Standards for Well Design Integrity; • Risk identification and mitigation through Safety Cases; • Robust barriers to protect against blow-out prevention; and • Real-time monitoring during drilling operations. <p>A worst case scenario well blow out may result in entrained and dissolved concentrations that are above thresholds that may impact sensitivities in the area.</p> <p>Recovery Barrier: Regulator accepted Oil Spill Contingency Plan outlines response activities to reduce the environmental impact and links to the blowout contingency plan that includes:</p> <ul style="list-style-type: none"> • a capping program; • sufficient casing strings available to be able to drill a relief well; • selecting a proposed location for a relief well; • a relief well design; • dynamic kill requirements; • identification of available potential relief well drilling units suitable for the conditions; and • contracts in place with global Emergency Well Control companies.