10 Cumulative, Transboundary and Accidental Events

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10.1 Introduction

This Chapter of the SWAP 3D Seismic Survey Environmental and Socio-Economic Impact Assessment (ESIA) discusses:

- Cumulative and transboundary impacts; and
- Accidental events that could potentially occur during the SWAP 3D Seismic Survey and the control, mitigation and response measures designed to minimise event likelihood and impacts.

A qualitative assessment has been undertaken to determine the significance of these impacts.

10.2 Cumulative Impacts

As outlined in Chapter 3, cumulative impacts arise from:

- Interactions between separate project-related residual impacts; and
- Interactions between project-related residual impacts in combination with impacts from other projects and their associated activities.

Cumulative impacts on environmental and socio-economic receptors can result from the incremental impact of a project activity when added to other past, present, and reasonably foreseeable future activities. Cumulative impacts arising from individually minor but collectively significant activities/events, which may occur simultaneously, sequentially, or in an interactive manner.

BP, in consultation with Ministry of Ecology and Natural Resources (MENR), has identified a number of activities and projects in the vicinity of the SWAP 3D Seismic Survey Area that have the potential to result in cumulative impacts. These activities and projects are located offshore and the cumulative impact assessment therefore focuses on marine and coastal receptors. As no onshore activities other than those associated with the 3D Seismic Survey have been identified cumulative impacts are not expected.

10.2.1 Cumulative Impact Between Separate Project Impacts

Due to the nature of the residual impacts from the SWAP 3D Seismic Survey the potential for them to interact synergistically or in-combination and cause significant cumulative effects on the receiving environment is considered to be unlikely and has been scoped out from this assessment.

10.2.2 Cumulative Impacts with Other Projects

A description of identified activities and projects that have the potential to result in cumulative impacts is provided below and their location relative to the SWAP 3D Seismic Survey Area is presented in Figure 10.1:

- Routine BP activities within the Shah Deniz (SD) and Azeri Chirag Gunashli (ACG) Contract Areas. Activities include vessel movements and drilling activities that result in the generation of underwater sound, discharges to the marine environment (water column and seabed), and potential risks to navigational safety from the presence of vessels. These activities will be ongoing throughout the duration of the SWAP offshore 3D seismic survey.
- 2. The Shah Deniz Stage 2 (SD2) Project (the second stage of development of the SD Contract Area) includes the construction and installation of the fixed Shah Deniz Bravo (SDB) platform complex, drilling and completion of 26 wells, installation of subsea infrastructure tied back to the SDB platform and the installation of subsea export pipelines to the Sangachal Terminal. The wells associated with the SD2 Project are planned to be located in five clusters around the SD Contract Area and will all be drilled using a mobile drilling rig. The wells will then be tied into a manifold which will, in turn, be tied in the SDB platform complex using flowlines. These activities will result in the generation of underwater sound, discharges to the marine environment (water column and seabed) and potential risks to navigational safety.

SD2 Project activities to be undertaken during the SWAP 3D Seismic Survey (March to end of November 2016) are understood to include the installation of the SDB platform jackets, drilling and completion of a number of wells within the Northern Flank (NF) well cluster, installation of subsea infrastructure within the SD Contract Area (including manifolds and flowlines) and installation of the subsea export pipelines between the SD Contract Area and Sangachal Terminal.

As shown on Figure 10.1, the NF is the closest to the SWAP 3D Seismic Survey Area (Priority Area 4) located approximately 25km to the south. Based on the findings of the SD2 Project ESIA¹, SD2 activities in this location, such as the discharge of water-based muds and cuttings, are predicted to result in minor and localised impacts to the seabed and sea water quality. Cumulative impacts with the SWAP 3D Seismic Survey are therefore not anticipated.

With regard to the installation of the SD2 subsea export pipelines, the SD2 pipeline corridor route only crosses the SWAP 3D Seismic Survey Area in a single location within Priority Area 5 (refer to Figure 10.1). Based on the latest SD2 Project schedule, SD2 pipelay activities will be completed from March 2016 to May 2016. The SWAP 3D Seismic Survey activities in Priority Area 5 are not scheduled to commence until November 2016 and so SD2 pipelay activities and SWAP 3D Seismic Survey activities will not be undertaken at the same time, thereby avoiding the potential for cumulative impacts in this area.

Seismic surveys within the Azerbaijani sector of the Caspian Sea that have either recently been completed, or are planned in the future, are presented in Table 10.1. Surveys that have recently been completed are included to reflect the historical disturbance to key marine receptors that may have occurred in the last two years from similar activities.

Table 10.1:Other Completed and Planned Seismic Surveys in the Azerbaijani Sector of the
Caspian Sea

| Seismic Survey Survey Dates | | Company | Completed |
|--|--------------------------|------------------|-----------|
| Gum Deniz & Bahar 3D Seismic Survey | January - February 2015 | Bahar Energy Ltd | Yes |
| SD North East 2D Seismic Survey | October 2015 | BP | Yes |
| SWAP 2D Seismic Survey | November - December 2015 | BP | Yes |
| ACG 3D Seismic Survey | January - February 2016 | BP | No |

A detailed assessment of environmental and socio-economic impacts, based on the anticipated seismic survey activities and events, is presented in Chapters 8 and 9 of this ESIA, respectively. In each case the assessments have taken into account the existing control measures in place to manage the impact.

Using professional judgement and based on the known information relating to the schedule and activities of the other projects described above, the following receptors may be susceptible to cumulative impacts:

- Marine fauna (Caspian seal and fish); and
- Small scale coastal fishing.

¹ URS, 2013. Shah Deniz Stage 2 Project ESIA.





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10.2.2.1 Marine Fauna

Cumulative impacts on seals from the other seismic projects identified in the vicinity of the 3D Seismic Survey Area will span approximately 13 to 14 months and includes 2 seal migration periods, but impacts are expected to be limited. The ACG survey scheduled for January to February 2016 takes place at a time when seals are in the far north of the Caspian Sea as such no impact to seals from ACG survey are predicted. Similarly impacts to seals associated with the Gum Deniz & Bahar 3D Seismic Survey that was undertaken the previous year at the same time would be insignificant for the same reason. Seals are anticipated to pass through the SD Contract Area during the autumn migration (between October and November). Therefore the SD survey that took place in October 2015 was located in an area where northward migrating seals were likely to be present. While the 2D SWAP survey undertaken during November and December 2015 also had the potential to impact seals, the survey was scheduled such that activities would avoid the most sensitive seal areas. In addition mitigation measures including the use of soft start procedures were adopted to minimise potential underwater sound impacts within the marine environment. The geographic and temporal gaps between the past and planned seismic surveys and the use of the soft start procedure mean that there is limited scope for cumulative impacts to seals due to underwater sound. The 2D and the 3D SWAP projects will be operating at the same time as the autumn seal migration period in two successive years. However, both surveys have been scheduled to avoid peak sensitivities, injury impacts are avoided via the softstart and behavioural impacts will be minor and a year apart. Thus, the cumulative impact on seals is expected to be no more significant than that assessed for the 3D SWAP Seismic Survey in isolation as described in Chapter 8 Section 8.3.4.

The cumulative impact on fish is expected to be no more significant than that assessed for the 3D SWAP Seismic Survey in isolation as described in Chapter 8 Section 8.3.4. This is because there is no spatial or temporal overlap between the different past and planned seismic surveys that could affect the same populations of fish. The Gum Deniz/Bahar survey area overlaps very slightly with the 3D Seismic Survey Area but past and planned surveys in this area cover different times of year. The SD 2D survey that was undertaken in October 2015 and the ACG survey scheduled for January to February 2016 are located a significant distances from the 3D Seismic Survey Area and in much deeper waters where the species of fish present are known to differ as compared to those found in shallow waters. Also, the past and planned surveys are separated by months up to a year; based on the understanding of the sound sources used fish would have recovered from any impacts, such as temporary hearing shifts or disturbance, before the 3D Seismic Survey is due to start.

10.2.2.2 Small Scale Coastal Fishing

As described in Chapter 9 Sections 9.3.2 and 9.3.3, offshore activities associated with the SWAP 3D Seismic Survey will be undertaken within an area used for small scale coastal fishing. It is predicted that there will be moderate negative impacts to small scale coastal fishing as a result of the presence of seismic and support vessels and the operation of the seismic energy source and associated safety exclusion zones during the offshore seismic survey. These activities are expected to interfere with existing small scale fishing activities through a reduction in access to favoured fishing grounds, increased travel time of vessels (and fuel consumption) taken to reach fishing grounds due to the need to deviate around the vessels and the exclusion zones, and the associated increased cost of routine fishing operations. A Communication and Consultation Plan will be implemented and maintained as a mechanism of communicating with the communities.

Taking into consideration the activities and projects described in Section 10.2.2 above that have the potential to cause impacts, based on the location of the Project activities only the SWAP 2D Seismic Survey was assessed as having the potential to impact small scale fishing in the same area

The SWAP 2D Seismic Survey ESIA² predicted a moderate, adverse impact on small scale fishing due to the potential for the survey activities to interact with fishing activities, particularly offshore from Shikh, Bayil, Turkan and Zira. The combined duration of the SWAP 2D and 3D Seismic Surveys is approximately 11 months, with approximately a 3 month gap between the completion of the SWAP 2D Seismic Survey and start of the SWAP 3D Seismic Survey. Due to the short duration between the

² AECOM, 2015. SWAP 2D Seismic Survey ESIA.

completion of the SWAP 2D Seismic Survey and the start of the SWAP 3D Seismic Survey, cumulative impacts may arise due to the potential for continued interference of small scale fishing activities over time. However, the SWAP 2D Seismic Survey activities will be undertaken outside the area 2-3 nautical miles from the coast line within which small scale coastal fishing is normally undertaken.

The cumulative impact on small scale fishing is expected to be no more significant than that already assessed (moderate, adverse) as described in Chapter 9 Sections 9.3.2 and 9.3.3 as there is no temporal or geographic overlap between the SWAP 2D and 3D seismic surveys, and small scale fishermen will be fully informed of the offshore activities in advance.

The potential direct and cumulative impacts are minimised as far as practicable through the implementation of the existing control measures described in Chapter 9 Sections 9.3.2 and 9.3.3, and no additional mitigation is required.

Any grievances raised by affected fishermen will be managed through the grievance procedure which will set out the processes through which complaints are received, resolved and documented. The process will be designed such that complaints received are managed appropriately, and those corrective actions to resolve complaints are implemented effectively and in a timely manner.

10.3 Transboundary Impacts

The potential transboundary impacts associated with the SWAP 3D Seismic Survey Project activities are considered to be limited to greenhouse gas (GHG) emissions contributing to the global greenhouse effect.

10.3.1 Greenhouse Gas Atmospheric Emissions

The estimated volume of GHG emissions (carbon dioxide, methane, nitrous oxide) generated by defined SWAP 3D Seismic Survey activities are presented in Chapter 4 Table 4.8 of this ESIA.

Figure 10.2 presents the estimated volume of SWAP 3D Seismic Survey total GHG emissions compared with the annual 2014 GHG emission volumes reported for BP's Azerbaijan operations in the AGT Region³. Figure 10.2 demonstrates that the estimated SWAP 3D Seismic Survey GHG emissions represent approximately 0.37.% of the annual operational GHG emissions from BP's upstream activities in Azerbaijan in 2014.

The most recently published GHG emissions data for Azerbaijan estimated a total of 48,209 kilotonnes of GHG emissions were emitted in 2010⁴; 76% of which was estimated to be generated by the energy sector. Total GHG emissions for 2015 were forecast to be approximately 49,000 kilotonnes. As a proportion, the estimated GHG emissions for the SWAP 3D Seismic Survey are expected to contribute approximately 0.0306% to the 2015 national total.

³ BP Exploration (Caspian Sea) Limited, 2014, BP in Azerbaijan Sustainability Report 2014

⁴ UN Framework Convention on Climate Change (UNFCCC), 2014. The First Biennial Updated Report of the Republic of Azerbaijan to the UN Framework Convention on Climate Change. Submitted in accordance with the UN Framework Convention Available on Climate Change Conference of the Parties (COP) Decision 1/CP.16. Baku. at: http://unfccc.int/resource/docs/natc/aze_bur1_eng.pdf?bcsi_scan_e956bcbe8adbc89f=0&bcsi_scan_filename=aze_bur1_eng.p df Accessed August 2015

Figure 10.2: Estimated SWAP 3D Seismic Survey Total GHG Emissions Compared to Reported 2014 BP Azerbaijan Annual GHG Emissions



10.4 Accidental Events

Accidental Events are considered separately from routine and non-routine activities as they only arise as a result of a technical failure, human error or as a result of natural phenomena such as a seismic event. Potential accidental events that may result in potentially significant environmental impacts during the SWAP 3D Seismic Survey have been identified and include:

<u>Offshore</u>

- Vessel collision with other marine users, infrastructure and Caspian seals;
- Release of chemicals/ waste from the 3D survey source, node and support vessels; and
- Spill of marine diesel from the 3D survey source, node and support vessels, including a worst case scenario of a full fuel inventory loss (maximum 10 m³).

<u>Onshore</u>

- Road accidents; and
- Leaks and spillages.

The likelihood of these events occurring, the consequences, the mitigation and the control, mitigation and response measures designed to minimise event likelihood and impact magnitude are described in the sections below.

10.4.1 Offshore

10.4.1.1 Vessel Collision

The SWAP Contract Area is located within a busy shipping area, through which international and regional shipping passes regularly in addition to numerous smaller vessels that provide offshore support to the oil and gas industry, as well as commercial fishing vessels travelling between the

offshore fishing grounds to landing harbours. The SWAP 3D Seismic Survey activities will take place in waters between 0 and 25m deep, where the density of offshore infrastructure is relatively high. There is therefore potential of a collision between SWAP 3D Seismic Survey Project vessels and shipping traffic, fishing vessels, or offshore infrastructure. A range of maritime and navigation safety measures outlined in Chapter 4 Section 4.8.1 are expected to minimise the risk of collision. Furthermore, a hazard survey of the Survey Area will be undertaken by BP to confirm the location of seabed infrastructure and other hazards prior to the seismic survey to inform seismic line design and to minimise potential for any accidental interference. With preventative measures in place the potential impacts on other marine users and infrastructure as a result of collision are unlikely to be significant.

Although highly unlikely to occur, the potential for collision of Caspian seals with source vessels or source arrays cannot be excluded, and may cause injury or lethal outcome for individual seals. The SWAP 3D Seismic Survey programme (refer to Chapter 4 Section 4.2) across each Priority Area has been planned taking into account sensitive periods for seals thus minimising activities within sensitive areas during migration periods. Furthermore, seismic survey vessels will operate at slow speed (5-7 km/h), will have trained observers onboard monitoring animal movement during daylight hours and a soft start procedure will be implemented during start-up of the source array(in water depths greater than 2m). Caspian seals are also expected to avoid areas of increased underwater sound and collision risk is likely to be limited and of low significance for the population.

10.4.1.2 Release of Chemicals / Waste

A number of chemicals in small quantities will be stored and used onboard the seismic and survey vessels throughout the survey for cleaning and maintenance purposes e.g. cleaning fluids, paints etc. Waste streams generated during the seismic survey activities will be stored on board in dedicated containers. The likelihood of an accidental release of chemicals or waste to the marine environment is considered to be very low given the measures as set out in Section 10.4.1.4 below.

10.4.1.3 Marine Diesel Spills

As described within Chapter 4 the SWAP 3D Seismic Survey will be undertaken by a number of survey vessels operating across different water depth zones along the pre-determined survey lines within the Priority Areas, and support vessels providing other functions. While considered unlikely it is possible due to mechanical failure, collision, grounding, or fire the diesel inventory of the fuel tanks onboard one or more of the vessels may be released to sea. Analysis of water transport accident statistics by the International Association of Oil & Gas Producers⁵ shows that ship to ship collisions represent only 12% of total ship losses and that the likelihood of this occurring is extremely low.

As a realistic worst case it was assumed that the full fuel inventory of the largest survey vessel (GeoTiger) is released to sea (10m³). In reality fuel is typically stored in a series of smaller tanks which are double bottomed and connected by valves and it is unlikely that contents of all the tanks would be lost simultaneously. Furthermore, the hull of some survey vessels is double skinned.

Properties of Marine Diesel

Diesel fuel is a light, refined petroleum product, and what is commonly referred to as "marine diesel" is often a heavier intermediate fuel oil which is a blend of heavy gasoil that may contain very small amounts of black refinery feed stocks, but has a low viscosity up to 12 centistokes $(cSt)/40^{\circ}$ C so it does not require to be heated for use in internal combustion engines. When spilled on water, diesel fuel spreads very quickly to a thin film of rainbow and silver sheens, whereas marine diesel may form a thicker film of dull or dark colours and persist on the surface for longer.

The key processes that govern the fate of hydrocarbons at sea are shown in Figure 10.3. When oil is released into the marine environment it undergoes a number of physical and chemical changes as a result of evaporation, dissolution, dispersion, emulsification, sedimentation, photo-oxidation and bio-

⁵ International Association of Oil & Gas Producers (OGP), 2010. Water Transport Accident Statistics, Risk Assessment Data Directory, Report No. 434 – 10.

degradation processes, collectively known as weathering. These changes are dependent upon the type and volume of oil spilt, and the prevailing weather and sea conditions.

Evaporation and dispersion are the two main mechanisms that act to remove diesel type fuels from the sea surface, whilst oxidation and biodegradation break down hydrocarbons into basic elements at later stages.

Marine diesel has a relatively low viscosity and is readily dispersed into the water column when wind speeds reach 5 to 7 knots or the sea state is approximately Force 2 Beaufort scale or higher. It is much lighter than water, therefore it is not possible for the diesel to sink and accumulate on the seabed as pooled or free oil. However, it is possible for the diesel to be physically mixed into the water column by wave action, forming small droplets that are carried and kept in suspension by the currents. Diesel dispersed in the water column can adhere to suspended sediments, which then settle out and are deposited on the seabed. This process is more likely to occur in near shore areas or river estuaries rather than in open marine environment.

Compared to unrefined crude oils, marine diesel is not very sticky or viscous. When spills of marine diesel do strand on the shoreline, the diesel tends to penetrate porous sediments quickly and degrade over time, but also to be quickly washed off hard surfaces by waves. In these situations, marine diesel is readily and completely degraded by naturally occurring microbes within one to two months.

In terms of toxicity to marine organisms, diesel is considered to be one of the most acutely toxic oil types.⁶



Figure 10.3:Weathering Processes Acting on Spilled Oil

⁶ NOAA Office of Response and Restoration. <u>http://response.restoration.noaa.gov</u> (accessed November 2015).

Vessel Marine Diesel Spill Modelling

To assess the potential impact of the loss of the complete fuel inventory from the largest seismic survey vessel (GeoTiger), spill modelling was undertaken using the OSCAR modelling software capable of predicting the fate of spills in the marine environment.

Four potential release locations were selected within four Priority Areas taking into account the proximity of sensitive environmental receptors and resources (Figure 10.4). Table 10.2 provides a summary of the model inputs. The results of the spill modelling are summarised in the following sections and the full modelling report is provided in Appendix 10A.

| Scenario | Release C (Long | oordinates g, Lat) | Oil Type | Release Depth/ Duration | Release Volume | Average Sea Surface Temperature | Month of Spill | | |
|-----------------|--------------------|-----------------------|------------------|-------------------------------|-------------------|---------------------------------------|-------------------|-------------------|---------|
| Priority Area 1 | 49.788654 | 40.298773 | | | | 9 ° C | Mar - Apr | | |
| Priority Area 2 | 50.438107 | 40.39073 | Marine Diesel | Marine Diesel | Marine | Surface/ | $10 m^3$ | 22 ⁰ C | Jun-Jul |
| Priority Area 4 | 50.32896 | 40.288607 | | | 1 hour | 10 m | 21.5 ° C | Sep - Oct | |
| Priority Area 5 | 49.666547 | 40.217087 | | | | 14 º C | Nov | | |

 Table 10.2:
 3D Seismic Survey Diesel Inventory Loss Scenarios – Input Data



Figure 10.4: Vessel Marine Diesel Spill Modelling Release Locations



Modelling Results

Both stochastic and deterministic scenarios were run for the spill scenarios shown in Table 10.2 above. From stochastic simulations the worse-case scenarios in terms of shoreline impact (greatest volume of marine diesel reaching shoreline) were identified and re-run as single deterministic simulations so that the fate of diesel can be analysed in greater detail.

Table 10.3 below presents the key outputs from the stochastic modelling. The surface and shoreline oiling probability maps are provided in Figures 10.5–10.12 and additional illustrative graphs can be found in Appendix 10A. Deterministic modelling was carried out for the scenarios that would result in the maximum mass of diesel ashore, as detailed in Table 10.4.

| Scenario | Surface Area with ≥5% Probability of 0.04 µm Diesel Thickness (km²) | Shoreline Length with ≥1% Probability of Diesel Mass Exceeding 0.169 tonnes/km (km) | Shortest Arrival Time to shore (hh:mm) | Maximum Mass of Diesel Ashore (tonnes) |
|-----------------|---|---|--|--|
| Priority Area 1 | 5.68 | 9.05 | 00h:40m | 8.47 |
| Priority Area 2 | 7.06 | 17.82 | 03h:20m | 8.06 |
| Priority Area 4 | 1.37 | 19.52 | 01h:20m | 8.22 |
| Priority Area 5 | 5.08 | 7.35 | 02h:20m | 6.91 |

| Table 10.3: | Stochastic Simulation Output Summaries for Priority Areas 1, 2, 3 a | and 4 |
|-------------|---|-------|
|-------------|---|-------|

Table 10.4:Shoreline and Surface Impacts during Worst Case (Deterministic) ShorelineDiesel Oiling Scenarios

| Scenario | Extent of Shoreline Diesel Oiling after 30 days (km) | Mass of Diesel Onshore after 30 days (tonnes) |
|-----------------|---|--|
| Priority Area 1 | 1.14 | 0.59 |
| Priority Area 2 | 1.42 | 0.64 |
| Priority Area 4 | 0.57 | 0.58 |
| Priority Area 5 | 1.70 | 0.79 |

The stochastic modelling results show that following the spill marine diesel would rapidly spread out to form a thin sheen on the sea surface. Figures 10.5, 10.7, 10.9 and 10.11 show the probability of surface diesel exceeding 0.04 μ m thickness, which is the lower limit of visible oil on the sea surface – a "sheen" – as defined by the Bonn Agreement Oil Appearance Code (BAOAC) system⁷. The surface area with >5% probability of oiling is predicted to vary between 1 and 7 km² for different Priority Areas (Table 10.3) with a spill in Priority Area 2 predicted to result in the largest area of sea surface being affected. Diesel on the surface is not expected to persist in any one location for more than 24 hours, being evaporated, dispersed or stranded under the effect of winds and currents. The extent of the area where diesel in water (dissolved and dispersed) concentration is anticipated to exceed the 58ppb threshold⁸ in the water column (>5% probability) is limited to a few kilometres around the release locations for a maximum period of 1-2 days (refer to Appendix 10A).

⁷ Lewis, A. (2007). Current Status of the BAOAC (Bonn Agreement Oil Appearance Code): A report to the Netherlands North Sea Agency - Directie Noordzee.

⁸ A minimum threshold for shoreline emulsion mass of 0.169 tonnes/km was used within the stochastic simulations. These values are the lower limit of the "Light Oiling" threshold used by The International Tanker Owners Pollution Federation Ltd (ITOPF, 2014). The threshold of 0.169 tonnes/km for condensate releases was calculated based on: a) the length of the hypotenuse of each surface grid (1060 m); b) a mean shoreline width of 2m; c) minimum Light Oiling threshold of 0.1litres/m² and d) emulsion density of 846kg/m³ @STP (based on 2% water uptake).

Probabilistic modelling results show that diesel will start washing ashore within one hour of the release under certain wind and current conditions, with a maximum volume of stranded diesel potentially reaching 6.91 to 8.47 tonnes depending on the release location (Table 10.3). Figures 10.6, 10.8, 10.10 and 10.12 illustrate the probability of shoreline oiling above the emulsion mass threshold of 0.169 tonnes/km⁹, which equates to a diesel thickness of 1mm on the shoreline. The coastal topography within Priority Areas 2 and 4 is more irregular, including numerous harbours and islands as well as the Absheron Peninsula, thus resulting in a potentially greater extent of impacted shoreline (17-20 km range) compared to that of Priority Areas 1 and 5 (7-9 km range). It must be noted that the probability of shoreline being impacted is low, and out of the multiple variations of meteorological conditions modelled only up to 5% of real case scenarios may result in shoreline oiling.

⁹ A minimum threshold for shoreline emulsion mass of 0.169 tonnes/km was used within the stochastic simulations. These values are the lower limit of the "Light Oiling" threshold used by The International Tanker Owners Pollution Federation Ltd (ITOPF, 2014). The threshold of 0.169 tonnes/km for condensate releases was calculated based on: a) the length of the hypotenuse of each surface grid (1060 m); b) a mean shoreline width of 2m; c) minimum Light Oiling threshold of 0.1litres/m² and d) emulsion density of 846kg/m³ @STP (based on 2% water uptake).



Figure 10.5: Surface Oiling Probability With Diesel Thickness Over 0.04 µm (minimum visible sheen as per BAOAC), Priority Area 1





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Figure 10.7: Surface Oiling Probability With Diesel Thickness Over 0.04 µm (minimum visible sheen as per BAOAC), Priority Area 2



Figure 10.8: Shoreline Diesel Oiling Probability Where Shoreline Diesel Mass Exceeds 0.169 tonnes/km, Priority Area 2

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Figure 10.11: Surface Oiling Probability With Diesel Thickness Over 0.04 µm (minimum visible sheen as per BAOAC), Priority Area 5





December 2015 Draft Deterministic modelling of the worst case (maximum diesel mass ashore) scenarios (refer to Table 10.4) for individual Priority Areas indicate that 30 days after the diesel release less than 10% of the total spill volume (<1 tonne) can remain stranded along 0.5-2 km shoreline, while the rest of diesel would evaporate and biodegrade. A small fraction of approximately 5% can be absorbed by sediments. Figure 10.13 presents the predicted fate of the relative proportions of the diesel release in Priority Area 2 as an example with results for Priority Areas 1, 4 and 5 provided in Appendix 10A.





Impact of Diesel Release

Hydrocarbons have the potential to cause detrimental effects on water and sediment quality, marine and coastal flora and fauna, including plankton, benthic invertebrates, fish, seabirds, and marine mammals that may come into contact with an area of a spill. An indirect effect on fisheries and potentially human health via the food chain is also possible depending on the scale of the spill and its proximity to the fishing grounds. The vulnerability of biological receptors to hydrocarbon spills is summarised within Table 10.5.

Based on the results of the diesel spill modelling presented above, and the existing environmental and socio-economic conditions described in Chapters 5 and 6, an assessment of the potential impacts on the key marine and coastal receptors has been undertaken and discussed below.

Table 10.5: Vulnerability of Receptors (Marine and Coastal Flora and Fauna and Fisheries) to Hydrocarbon Spills^{10,11,12,13}

| Receptor | Vulnerability to Hydrocarbons |
|--------------------------|---|
| Plankton | Abundance of phytoplankton may increase after a hydrocarbon spill due to increased nutrient availability, while zooplankton, fish larvae and eggs may suffer increased mortality due to toxicity in the water column, and therefore can affect the food chain of other fish species. Although localised mortality is likely, the overall effect on plankton communities is not statistically significant and generally short-term. Following a spill plankton biomass may fall, however, after a few weeks, population often returns to baseline levels as a as a result of high reproductive rates and redistribution of species from outside the affected area |
| Benthic Invertebrates | Effects on the benthos include acute toxicity and organic enrichment. Offshore impacts are typically minimal, and influenced by water depth and local hydrography. Sub-tidal regions generally have lower hydrocarbon concentrations after a spill than inter-tidal regions as often the hydrocarbon is carried and spread at the sea surface. Recovery times are variable, and for light hydrocarbons are generally in the region of a few months to a few years. Impacts can include rapid mortality of sensitive species such as crustaceans and amphipods; a period of reduced species population and abundance; a period of altered community structure with increased abundance of opportunistic species. |
| Fish | Evidence suggests that fish are able to detect and avoid hydrocarbon-contaminated waters. This avoidance may cause disruption to migration or spawning patterns. Hydrocarbon exposure in fish can lead to mortality or sub-lethal impacts on growth, physiology, behaviour and lowered disease resistance. Fish populations are more sensitive to hydrocarbon pollution in shallow waters than in deep waters, with hydrocarbon concentrations being typically higher in the upper column. Fish may ingest large amounts of hydrocarbons through their gills. Fish that have been exposed to hydrocarbons may suffer from changes in heart and respiratory rate, enlarged livers, reduced growth, fin erosion and a variety of effects at biochemical and cellular levels. Hydrocarbons toxicity can also affect reproductive capacity negatively and/or result in deformed fry. Fish eggs and larvae are more vulnerable to hydrocarbons is more likely. However, as most fish species have extensive spawning grounds and produce large numbers of eggs, there is unlikely to be any effect on numbers in the adult populations. Stocks may be at risk from a spill if it is large and coincides with spawning periods. Longer term impacts of a hydrocarbon spill have shown genetic damage, physical deformities, reduced abundance and growth and compromised survival of some life stages. |
| Birds | The spilled hydrocarbon can penetrate into the plumage of sea birds, reducing its insulating ability, and making them more vulnerable to temperature fluctuations and much less buoyant in the water. This can lead to death from hypothermia or drowning. In their efforts to clean themselves from hydrocarbon, the birds may inhale or ingest the hydrocarbon. As hydrocarbons are toxic, this may result in serious injuries/health effects such as pneumonia, congested lungs, intestinal or lung haemorrhage, liver and kidney damage. Hydrocarbons may also affect the reproductive success of the birds as hydrocarbons from feathers of a bird that is laying on eggs may pass through the pores in the eggshells and either kill the embryos or lead to malformations. |
| Seals | Seals are very vulnerable to hydrocarbon pollution because they spend much of their time on or near the surface of the water. They need to surface to breathe, and regularly haul out onto beaches. During the course of a hydrocarbon pollution incident, they are at risk both when surfacing and when hauling out. Seals may be damaged through the ingestion of food contaminated by hydrocarbons or the inhalation of hydrocarbon droplets and vapours. Oil, especially light oils and hydrocarbon vapours, will attack exposed sensitive tissues. These include mucous membranes that surround the eyes and line the oral cavity, respiratory surfaces, anal and urogenital orifices. This can cause corneal abrasions, conjunctivitis and ulcers. Consumption of contaminated prey can lead to the accumulation of hydrocarbons in tissues and organs. |
| Fisheries | Fish exposed to hydrocarbons may become tainted, defined as giving the product a petroleum taste or smell. Commercial fish species rarely become tainted in open deep waters, as they are able to avoid the affected area. However, major spills can result in loss of fishing days and exclusion zones and bans on certain species lasting for a whole season may be enforced. |

¹⁰ U.S. National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration

⁽http://response.restoration.noaa.gov).

 ¹¹ Petroleum Industry Environmental Conservation Association (IPIECA), 1997. Guidelines on Biological Impacts of Oil Pollution. Volume 8: Biological Impacts of Oil Pollution: Fisheries. International.
 ¹² Effects of Oil Pollution on the Marine Environment, 2011. Technical Information Paper 13. International Tanker Owners

Pollution Federation Limited (ITOPF)..¹³ The Ireland Department of Communications, Energy and Natural Resources, Petroleum Affairs Division, 2011. Rules and Procedures for Offshore Petroleum Exploration and Appraisal Operations.

Plankton

For all modelled release locations the concentrations of diesel in water above the 58 ppb threshold are not expected to persist for longer than 1-2 days, and are limited to the point of release. The exposure of plankton (excluding fish larvae) to toxic levels of hydrocarbons is therefore expected to be short term and localised. During the peak period of plankton production (spring and autumn) the biomass exposed to diesel would increase but is not expected to be considerable in comparison with the total production levels. Plankton concentrations are expected to return to baseline levels as a result of generally high reproductive rates and redistribution of species from outside the affected area. As a result, the overall impact on the plankton communities is not considered to be significant.

Benthic Invertebrates

As described in Chapter 5 Section 5.5.4.2 it is considered unlikely that the SWAP 3D Seismic Survey Area supports benthic species of conservation significance, however a range of the species present play an important role in supporting critical functions of the local ecosystem (i.e. polychaetes, oligochaetes, cirripedia (barnacles), cumacea (hooded shrimp), amphipoda (small crustaceans); decapods (crabs, prawns and lobsters); bivalve molluscs (shellfish such as mussels); and gastropoda (snails and slugs etc.).

The results of the diesel spill modelling suggest that exposure of benthic communities and sediments to diesel is possible due to prevailing shallow water depths and shoreline proximity. Potentially, up to 20 km of coastal habitat can be impacted by 6-9 tonnes of diesel (Table 10.3). Potential impacts can include: (i) rapid mortality of sensitive species such as crustaceans, amphipods, and bivalves; (ii) a period of reduced species population and abundance; (iii) a period of altered community structure with increased abundance of opportunistic species. It should be noted that bivalves and crustaceans located in shallower water are particularly vulnerable to toxicity of the light aromatic compounds in diesel.

Around 90% of diesel is predicted to evaporate and biodegrade within 30 days after the spill, however the recovery times for benthos would vary depending on the environmental conditions and species affected. For light type hydrocarbons such as diesel the recovery of predominantly open sandy/silty coastal/ shallow water benthic habitats is likely to be in the region of a few months up to a year.

Considering a relatively limited area of the coastal zone being affected by stranded diesel and medium term recovery rates, the overall impact to benthic invertebrates in all Priority Areas is expected to be insignificant.

Fish

As discussed in Chapter 5 Section 5.5.6.2, the key locations for fish species in the southern Caspian are within the shallow water shelf areas. Maximum concentrations of fish are typically found at depths of up to 50 m throughout most of the year. The coastal region, particularly to the south of the Absheron Peninsula, is important for non-migratory (resident) species and provides breeding and nursery habitats for almost all commercial fish species. This area is particularly sensitive in early spring, summer and autumn, when resident species are spawning. Migration of sturgeon, roach, grey mullet and other species take place through the SWAP 3D Seismic Survey Area. This occurs from the south to north in the spring and north to south in the autumn.

The majority of the fish species present in the SWAP 3D Seismic Survey Area are of low conservation status, apart from five sturgeon species classified as Endangered in the International Union for Conservation of Nature (IUCN) Red List and most likely to be present in shallow waters during spring and summer migrations.

If a worst case spill is to occur during any time of the planned seismic survey, between March to November, different groups of fish species may be affected.

Fish are known to have the ability to detect hydrocarbons in water through olfactory (smell) or gustatory (taste) systems and tend to avoid contaminated areas. It can be assumed therefore that the majority of adult fish would avoid the area of a spill, although in very shallow waters fish may be more

restricted between the seabed and the diesel on the sea surface. Spill avoidance behaviour can disrupt migration routes for some fish species. This has the potential to impact the migration of species of sturgeon and shad and semi-migratory species such kilka and mullet. Juveniles and larvae are more vulnerable to oil spills as they have limited ability to move away from the contaminated zone, which may have implications for the reproduction of these species. It should be noted that protected sturgeon species do not spawn within the SWAP 3D Seismic Survey Area.

Spill modelling indicates that diesel concentrations in water column that can cause toxic effects on fish are non-persistent with a large proportion of diesel evaporating, and biodegrading within the first few days after the release. Considering spatial and temporal limitations of a worst case 10m³ spill no significant impacts on fish are anticipated.

Seals

As described in Table 10.5, Caspian seals could be irreversibly affected by hydrocarbon spills through coating, inhalation and ingestion of the spilled hydrocarbons if they happen to be within the area of a spill or if the spill affects their haul out sites.

Chapter 5 Section 5.5.6.3 describes the Caspian seal spring and autumn migration within Azerbaijani waters with peak numbers of migrating seals present in April-May and November. The spring migration is considered to be the most sensitive period for seals in the vicinity of the Absheron Peninsula as they are more vulnerable due to depleted fat reserves following the winter pupping and mating season. Having replenished fat reserves many seals leave the islands of the Absheron Peninsula and Oil Rocks in June and head towards the central part of the Caspian Sea, however approximately one third of the seals remain and concentrate north of the Absheron Peninsula throughout summer and autumn. The seals usually keep a distance of 1-2 km away from the coastline although they can be observed anywhere between the coast and the central part of the Caspian Sea. The migration routes and distribution of seals are not fixed and are closely linked with the variable distribution of kilka, which is the main source of food for seals.

Recent seal observation data, from 2010 to 2015, in the area around the Absheron Peninsula indicate the presence of seals in areas in and adjacent to the SWAP 3D Seismic Survey Area (as shown on Figures 10.5–10.12). Based on this data and local specialist knowledge, the area to the south east and east of the Absheron Peninsula including Pirallahi and Chilov Islands and other islands in this area (overlaps with Priority Areas 2 and 4) is the most sensitive. Seals are known to be present in these locations, sometimes in large groups, from early April to the end of May and from October to mid-December. The coastal zone to the west of the Absheron Peninsular, including Priority Areas 1, 3 and 5, is not that frequented by seals and only small groups or individual species are expected to be present.

The SWAP 3D Seismic Survey schedule has been planned taking into consideration Caspian seal sensitivities, for example Priority Areas 2 and 4 are scheduled to be surveyed in June-August and September-October, respectively with the survey within Priority Area 4 moving from the east to the west. This control measure ensures that seismic survey activities in these Priority Areas will avoid peak seal presence. In contrast to the spring migration the autumn migration is not characterised by large groups of seals using the islands of the Absheron archipelago.

The spill modelling confirmed that surface diesel thickness will be greatest near the spill location, dispersing and thinning out with distance and time, meaning seals within a few kilometres around the release location are most likely to suffer being coated in diesel. The duration of diesel remaining on the sea surface in most areas is not predicted to exceed 24 hours, and the probability of shoreline oiling in areas such as the Absheron Peninsula and the adjacent islands which are known to be used by seals for haul out is relatively low (less than 10% probability). As such, exposure of seals to spilled diesel is likely to be limited.

Despite limited spatial and temporal scale of a potential spill, seals are known to be highly sensitive to oiling and have slow recovery rates once being coated even with a small amount of hydrocarbons. Caspian seals are an IUCN endangered species and are under pressure from various natural and anthropogenic stressors, therefore even small-medium scale exposure to toxic effects of diesel within

sensitive areas for seals such as in the vicinity of the Absheron Peninsula and the adjacent islands (Priority Areas 2 and 4) can result in a potentially significant impact.

As shown in Chapter 5 Figure 5.15 the numbers of seals within Priority Areas 1, 3 and 5 are anticipated to be much lower than seal numbers in Priority Areas 2 and 4 as in general only small groups of seals migrate through these areas. The impact of a spill in this area is unlikely to be significant.

Areas of Conservation and Ecological Importance

As discussed in Chapter 5 Section 5.4.7 there are a number of Protected Areas (IUCN Categories II and IV), Important Bird and Biodiversity Areas (IBAs), and Key Biodiversity Areas (KBA) located along the coastline of Azerbaijan. These are shown on the surface and shoreline oiling probability maps (Figures 10.5-10.12).

In the event of a spill in close proximity to the shore (as modelled in the scenarios listed in Table 10.2), these areas can be potentially exposed to stranded diesel. The shoreline oiling probabilities predicted by modelling for each of these areas of conservation and ecological importance are summarised in Table 10.6, and generally do not exceed 5%. The probability of diesel beaching at the Absheron National Park (including Shahdili spit and Pirallahi Island) is not expected to exceed 10%. The recovery of different habitats from an oil spill varies but for light type hydrocarbons such as diesel the recovery of predominantly open costal habitats is likely to be in the region of a few months up to a year. Based on this medium term recovery and considering international conservation status and ecological importance of these areas, the potential impacts are assumed to be significant. The effects on the IBAs are further discussed in the following section.

Birds and Important Bird and Biodiversity Areas

As discussed within Chapter 5 Section 5.4.6.4 the Caspian region supports a high diversity of bird species, with a large number of endemic and protected species present. As such, the coastal zone of the Caspian Sea has been identified as an area of ornithological importance, supporting both internationally and nationally significant numbers of migrating and overwintering birds, which is reflected in the designation of a number of important bird and biodiversity areas.

Species composition changes sharply during migration periods, leading to sensitive periods during overwintering and migration. A large number of overwintering and migrating birds will be present within and the vicinity of the SWAP 3D Seismic Survey Area throughout the year. There are, however, some key periods and areas of higher sensitivity. Ducks and coots are overwintering from December to February and the presence of migrating species peaks in March and November. The IBAs are the key habitats for these groups of birds. Limited information is available regarding the offshore distribution and abundance of birds in the southern Caspian Sea, however there will be a number of birds that plunge dive to feed and species that spend the majority of their time on the sea surface present throughout the year.

The Absheron National Park Protected Area designation relates to the onshore Shahdili Spit, which is also an IBA. Two large islands; Pirallahi and Chilov; and several small islands, including Boyuk and Kichik Tava, Yal, Koltish, Gu and Garabatdag belong to the adjacent Absheron Archipelago (north) and Pirallahi Bay IBA. As described within Chapter 5 Section 5.4.7 these islands are considered important sites for nesting and breeding for various bird species. The SWAP 3D Seismic Survey is planned to commence in Priority Area 2 in June in the north of the Priority Area. The bird nesting season begins at the end of April/beginning May and continues until mid-July.

An accidental release of diesel can impact birds offshore and in the nearshore / coastal areas. The typical impacts to birds from a hydrocarbon spill are summarised in Table 10.5 and include toxic effects, mortality, as well as reduced reproduction. Although the modelling indicates some of the important bird and biodiversity areas may be exposed to elevated hydrocarbon concentrations as a result of surface or dispersed / dissolved diesel beaching on the shoreline, the extent of and persistence of such pollution is likely to be spatially and temporally limited. However, it should be noted that, once onshore, the diesel biodegrades and evaporates more slowly than when on the sea surface and that stranded diesel can become remobilised by wave action, which can result in isolated

and sporadic sheens on the sea surface a number of weeks after the release. Therefore, although the probability of diesel arriving at important bird and biodiversity areas is low, it is considered that the impact of a diesel release on birds at sea and the important bird and biodiversity areas could potentially be a significant impact due to the spill potentially occurring during the most sensitive time of year for nesting birds in the region.

Table 10.6:Shoreline Oiling Probabilities for Designated Areas along the AzerbaijanCoastline

| Sensitive Areas ¹ | | Protected Area | Ornithological Important Site | Designation | Probability of Shoreline Oiling |
|------------------------------|--|----------------|----------------------------------|------------------------------------|---------------------------------------|
| 1 | Yashma Island | | ✓ | KBA ¹ /IBA ² | <1% |
| 2 | Absheron National Park (including Shahdili Spit and Pirallahi Island) ² | \checkmark | ~ | KBA/IBA IUCN Category II | 1-10% |
| 3 | Red Lake | | ✓ | KBA/IBA | 1-5% |
| 4 | Sahil Settlement | | ✓ | KBA/IBA | 1-5% |
| 5 | Sangachal Bay | | ✓ | KBA/IBA | 1-5% |
| 6 | Gobustan Area | | ✓ | KBA/IBA | <1% |
| 7 | Gil Island (or Glynanyi Island) State Nature Sanctuary | ~ | ~ | KBA/IBA IUCN Category IV | <1% |
| 8 | Pirsagat Island and Loc Island | | ✓ | KBA/IBA | <1% |
| 9 | Shirvan National Park | ~ | ~ | KBA/IBA IUCN Category II | <1% |
| 10 | Bandovan (or Byandovan) State Nature Sanctuary | ~ | | IUCN Category IV | <1% |
| Not | 26. | | | | |

¹ Shown on Figures 10.6 – 10.12.

² Comprises two adjacent IBAs: Shahdili Spit and Absheron archipelago (north) and Pirallahi Bay shown as 2a and 2b within Figures 10.7 – 10.10.

Fisheries and Other Marine Users

Socio-economic receptors such as fisheries, the tourist industry, and other coastal businesses, can also be exposed to the risk from an accidental spill. The likelihood of a diesel spill of a maximum 10m³ volume to have a significant effect on majority of these receptors is minor although negative public perception and media attention can be detrimental to BP's reputation. Fisheries are most sensitive to hydrocarbon spills and the potential impact on fisheries from a diesel spill is discussed in a greater detail below.

Chapter 6 Section 6.6 describes a number of important commercial fishing grounds (Oily Rocks and Makarov Bank) in the vicinity of the SWAP 3D Seismic Survey Area and smaller scale fishing areas and landing sites located along the coastline. These important fishing locations, including fishing grounds, licensed fishing areas and fishing villages are shown on Figures 10.5 - 10.12. It is understood that the high season for commercial fishing is during March to April and September to November whereas the peak fishing period for small scale fishing occurs between September and May, although fishing takes place throughout the year.

Table 10.4 outlines how hydrocarbon spills have the potential to affect fishery resources in a number of ways. Despite the susceptibility of fish larvae and juveniles to relatively low concentrations of hydrocarbons in the water column, adult free swimming fish and wild stocks of commercially important species are likely to detect and avoid hydrocarbon contaminated areas. Following a spillage, the reproductive success of unaffected fish, as well as the influx of larvae from unaffected areas should lead to the recovery of stock numbers. Given that many marine species produce vast numbers of eggs that are widely distributed by sea currents this means that species can recover from small mortality events relatively quickly.

However, fish can become tainted and contaminated with hydrocarbons. In the event of a hydrocarbon spill, if there are signs of fish oil tainting or contamination, any resultant imposed authority restrictions on fishing activities could result in detrimental financial impact upon local fisheries. Equally, lack of timely restrictions or illegal fishing can create a risk to human health from contaminated product consumption. A worst case scenario spill (10 m³) may affect small scale fishing grounds along the coast within the SWAP 3D Seismic Survey Area (shown in Figures 10.5-10.12). Although the impact is likely to be limited to a small number of fishermen, it can be potentially significant without adequate compensation in place as fishing represents the primary source of household income for the majority of fishermen. In contrast, large commercial fishing grounds such as Oily Rocks and Makarov bank are unlikely to be impacted by the diesel slick due to their distance from the SWAP 3D Seismic Survey Area (at least 10 km for Makarov Bank and 20 km for Oily Rocks). Given the low probability of a diesel spill reaching these fishing grounds, the impact to the large commercial fishing industry is considered to be low, with negligible impacts to stocks or fish quality anticipated.

Summary of Vessel Marine Diesel Spill Impacts

The loss of the entire diesel inventory stored onboard the largest seismic survey vessels (GeoTiger) has been modelled and the resulting impacts to environmental and socio-economic receptors has been assessed. As Section 7.4.1.3 shows, in general the diesel is not anticipated to persist in the environment in harmful concentrations or thickness on the sea surface for more than a few days following the release. Furthermore, the probability of the diesel reaching the shoreline from the release location is predicted to be low and out of the multiple variations of meteorological conditions modelled only 5% of scenarios resulted in shoreline oiling.

The potential impacts of the 10m³ diesel spill on plankton, benthic invertebrates and fish was considered to be insignificant. The seismic survey schedule has been planned to avoid the peak periods for Caspian seals (an IUCN Endangered species) presence, however even a small-medium scale exposure to the toxic effects of diesel within sensitive areas for seals such as in the vicinity of the Absheron Peninsula and the adjacent islands (Priority Areas 2 and 4) can result in a potentially significant impact. Due to the low numbers of seals predicted to be present within Priority Areas 1, 3 and 5 during the seismic survey the impact of a spill in these areas is unlikely to be significant.

The spill modelling has shown that in the event of a spill in close proximity to the shore there are a number of sites of conservation and ecological importance located along the coastline of Azerbaijan (refer to Table 10.5) that may be potentially exposed to stranded diesel, however the probability of this occurring is low (generally less than 5% but up to 10% in parts of the Absheron National Park). Based on this medium term recovery (few months to a year) period for habitats from a diesel spill, and considering the international conservation status and ecological importance of these areas, the potential impacts from a spill are considered to be potentially significant.

The modelling shows that some of the important bird and biodiversity areas may be exposed to elevated hydrocarbon concentrations as a result of surface or dispersed / dissolved diesel beaching on the shoreline following a spill, however the extent of and persistence of such pollution is likely to be spatially and temporally limited. Nevertheless, it is considered that the potential impact of a diesel release on important bird and biodiversity areas (and the birds present there) could have a potentially significant impact as the release would occur during the most sensitive time of year for nesting birds in the region.

Given the low probability of a diesel spill reaching important commercial fishing grounds such as Oily Rocks and the Makarov bank the impact to the commercial fishing industry is considered to be low, with negligible impacts to stocks or fish quality anticipated. The spill modelling shows that a spill may affect small scale fishing grounds along the coast. Although this impact is anticipated to be limited to a small number of fishermen, the impact could be potentially significant without adequate compensation in place as fishing represents the primary source of household income for the majority of fishermen.

The likelihood of a mechanical failure, collision, grounding, or fire or vessel collision resulting in the diesel inventory of the vessel fuel tanks being released to sea is considered to be extremely low. With regard to the seismic survey vessels the loss of the entire diesel inventory is considered particularly unlikely as diesel is stored in a series of small double-bottomed tanks which are connected by valves

and it is improbable that the contents of all the tanks would be lost simultaneously. Furthermore, the hull of some survey vessels is double skinned. The technical and operations control measures to minimise the risk of any diesel or hazardous material spill and the response measures to be implemented in the unlikely event a spill occurs are described in Section 10.4.1.4 below.

10.4.1.4 Spill Prevention and Response Planning

Spill Prevention

The specific technical and operational control measures in place to minimise the potential for spills during the SWAP 3D Seismic Survey offshore include:

- Audits of the seismic survey and support vessels will be undertaken to ensure vessels meet relevant BP standards (e.g. condition of the vessel, competence of crew and examination of the vessel Shipboard Marine Pollution Emergency Plan (SMPEP);
- Survey activities will be undertaken compliance with poor weather operational restrictions for vessels in line with BP's existing marine operations and geophysical survey procedures;
- Regular maintenance and inspection of equipment and high risk spill points (in particular bunkering hoses, bunds, storage tank valves etc.) will be undertaken;
- Chemical selection procedures will be implemented to minimise chemical use;
- Strict refuelling procedures to be followed will be implemented and bunkering operations will be supervised at all times for both the seismic and support vessels;
- Non-return valves will be installed on fuel transfer hoses;
- Regular preventative maintenance to prevent leaks by repairing or replacing equipment such as hoses and tanks will be undertaken;
- Staff training in in hazardous materials management, refuelling and waste management roles, as applicable to their roles will be provided;
- Implementation of appropriate handling and storage procedures and storage of all hazardous substances within designated areas and in fit for purpose containers (i.e. sealed/hermetic drums) to minimise the risk of leaks and spillage will be undertaken;
- Materials Safety data Sheets (MSDS) for all chemicals stored on board will be made available to facilitate efficient spill response;
- Reporting of all minor spills will be undertaken to detect underlying trends, and task risk assessments; and
- Appropriate spill response and containment equipment will be provided at specific locations based on risk assessment. This will allow rapid response should a spill occur.

Response Planning

BP has developed and maintains a range of Oil Spill Response Plans (OSRP) for its offshore operations in Azerbaijan. These plans establish the notification, response and follow-up actions that must be implemented should an accidental spill occur. Under MARPOL regulations the seismic survey and support vessels are required to develop and maintain a SMPEP. This document specifies the control and response measures specific to the vessel, focused on the actions to be taken to stop or minimise the spill and to mitigate the effects. The plan also includes responsibilities and lines of communication with regard to notification and reporting. The seismic contractor and BP will be responsible for ensuring the SMPEP for each vessel is aligned with the relevant AGT Region OSRPs and spill response procedures prior to the survey mobilisation.

Under the AGT spill procedures, spill incidents are categorised according to the level of resource required to mitigate them. BP has adopted the internationally recognised tiered response concept to oil spill response as shown in Table 10.7.

Table 10.7:Oil Spill Response Tiers

| Tier 1 | Tier 1 spills are defined as small operational spills that can be can be handled immediately by on- site personnel. In most cases, the response would be to clean up using on site resources. |
|--------|---|
| Tier 2 | Tier 2 spills are defined as spills that require additional local (in-country) resources and manpower that are not available on the site that the spill occurs. The site response team would carry out cleanup, aided by the dedicated Tier 2 oil spill contractor. |
| Tier 3 | Tier 3 spills are very large, possibly ongoing spills, which will require additional resources from outside the country of spill origin. Such spills are very rare and would only occur through events such as a well blowout or full diameter pipe rupture. All available spill contractors (from within and outside Azerbaijan) would carry out the physical response, with extensive support from the BP Incident Management Team and the Business Support Team. |

Reporting

Under the AGT spill reporting procedures, all accidental and non-authorised releases (liquids, gases or solids) will be internally reported and investigated. Existing external notification requirements agreed with the MENR will be adopted during the SWAP 3D Seismic Survey are:

- For liquid releases to the environment exceeding a volume of 50 litres, notification will be made to the MENR within 24 hours after the incident verbally and within 72 hours in the written form; and
- If the release to the environment is less than 50 litres, then information about the release will be included into the BP AGT Region Report on Unplanned Releases and sent to the MENR on a monthly basis.

A Protocol "On Agreeing the Main Principles of Cooperation for Regulation of Unplanned Material Releases" signed between BP and MENR in December 2012 defines an approved release as "a release that is permitted by applicable PSA, MENR permitted and/or approved documents including ESIA, EIA, Technical Note, Technical Letter, individual discharge request letters to MENR or any other written agreement with the MENR". Unapproved releases are those that do not fall into this definition.

10.4.2 Onshore

10.4.2.1 Road Accidents

Onshore seismic survey activities are planned to be undertaken seven days per week during daylight hours only. All source vehicles and OnSeis units (10 in total) will depart/ return to either the main base camp at Hovsan Port or one of the 3 sub-bases on a daily basis. Roads utilised during the onshore seismic survey will include the Baku-Salyan Highway, and a mix of paved and unpaved roads crossing Priority Areas 1, 2 and 3. Land use within these areas is predominantly residential, commercial, industrial, recreational, and agricultural, with the majority of the roads regularly utilised by businesses and the public.

Onshore seismic survey vehicle movements on the roads has the potential to increase the risk of accidents resulting in (i) spill of hazardous substances (discussed in Section 10.4.2.1 below); (ii) temporary road closure and nuisance to nearby residents and road users, and (ii) injuries and fatalities of road users or pedestrians.

BP and the seismic contractor will provide dedicated transport coordinators to control and coordinate vehicle journeys. Their responsibilities will include ensuring mechanical suitability of all vehicles, drivers' competency and day to day coordination of Project transport requirements. With the implementation of these control measures the probability of road accidents is considered to be low.

Mitigation Measures

Additional measures to mitigate the risk of road accidents will include:

- Development and implementation of a Journey Management Plan, detailing actions for improving driver and vehicle safety, enforcement of speed limits at all times, etc.;
- Vehicle movements will be minimised as far as possible;
- As far as possible the survey will be undertaken using existing roads, with a preference for use of surfaced roads and off road vehicle movements will be minimised as far as practical;
- A review of the proposed transport routes from a safety and operational perspective will be undertaken, which may result in changes to road geometry, signage, and signalling to mitigate safety risks;
- Vehicle speed limits established for different road surfaces will be adhered to at all times during the survey;
- Safe driving training will be provided to all workers operating vehicles and machinery;
- Limits for trip duration and arranging driver rosters to avoid fatigue and tiredness will be implemented;
- Regular vehicle inspections will be undertaken; and
- All road incidents will be reported and investigated by BP in line with the corporate incident management procedures.

10.4.2.2 Leaks and Spillages

The main leaks and spillage risks associated with onshore survey operations are related to fuel and lubricating oil spills infiltrating into the ground, reaching surface and ground waters and causing pollution. A description of existing ground conditions, surface and groundwater conditions and land use is provided in Chapter 5 Section 5.4 and Chapter 6 Section 6.5.

Fuel and Lubricating Oil Spills

The impacts from potential fuel spills can include adverse visual appearance, contamination of soils, surface and ground waters, and indirect risk to human health and wildlife.

Re-fuelling locations and procedures for the survey trucks, OnSeis units and support vehicles are described in Chapter 4 Section 4.6.5 and the adoption of these measures shall ensure that the potential for fuel spills are minimised with spills contained and no significant impacts anticipated. Considering there will be no refuelling in the field where spill control tends to be less efficient, there is a low probability of fuel being released to the environment.

Seismic source equipment is heavily dependent on hydraulic systems. Vibroseis trucks used in the seismic survey can hold large volumes of hydraulic fluid. When the vibrator engine is running, the hydraulic fluid is pressurised to 3000 pounds per square inch (psi). If a burst hose or leak occurs while the engine is running the hydraulic fluid will be ejected under pressure and lost very quickly. Shut-off systems typically cut power immediately in the event of a drop in hydraulic oil pressure, but spills still occur. Spills are not expected to cause significant impacts unless the spill occurs in the vicinity of highly sensitive human and ecological receptors.

Fuel spills as a result of a road or other logistical accidents are unlikely and will be effectively controlled through risk assessments and control procedures detailed in the Journey Management Plan and the Spill Prevention, Response, Notification and Close Out Actions Management Plan (refer to Chapter 11 Section 11.3.1). The worst case scenario spill can involve a loss of fuel tank's content from damaged vehicles, potentially totalling to hundreds of litres. Spilt diesel would spread and evaporate quickly on compacted and paved surfaces; on loose and impermeable soils most of it is expected to infiltrate into the ground affecting shallow water horizon and potentially seeping into surface water bodies including the coastal marine environment. Depending on the circumstances of the spill, the impacts from spills can be significant if located close to sensitive receptors and resources.

Spill Management Measures

The specific technical and operational control measures in place to minimise the potential for spills during the SWAP 3D Seismic Survey onshore include:

- Development and implementation of the SWAP 3D Seismic Survey Spill Prevention, Response, Notification and Close Out Actions Management Plan;
- Smaller light vehicles will only refuel at public fuel stations;
- Source vehicles and OnSeis units will be either refuelled from a fuel tank at Hovsan Port in a dedicated refuelling area or by fuel truck at one of the sub-bases. The refuelling area at Hovsan Port will be located on an impermeable surface and will include a bund wall capable of holding the content of the fuel tank. The refuelling area will be located away from storm water sewers, channels and water courses and will be protected from weather conditions. Refuelling procedure at sub-bases will be conducted using driptrays;
- Hazardous fuels, oils and chemicals will be securely stored in clearly marked containers in a contained area to prevent pollution;
- Regular maintenance of survey equipment and vehicles will be undertaken;
- Drip trays will be used when re-fuelling;
- Proper fuel nozzles on re-fuelling hoses will be used and shut-off valves will be installed on tanks;
- Spill kits and training of crew in the use of spill kits and clean-up will be provided; and
- Any contaminated soil caused by spill will be removed and restoration of the areas affected by spills will be undertaken.

With the implementation of the control measures described above the potential for a significant environmental or socio-economic impact from a spill of fuel or lubricating oils is considered to be low.