Edradour Area Development
Environmental Statement
DEV-WOS-EDR-10015-169

Rev	Date	Revision	Prepared	Reviewed	Project Approval
A02	4 Oct 12	Approved for Use	K. Watt	A. Hoy	C. Inglesfield
A01	21 Sep 12	Issued for Approval	K. Couston	I. Dixon	-
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R02	05 Aug 12	Re-issued for Review	K. Couston	I. Dixon	-
R01	17 Jul 12	Issued for Review	K. Couston	I. Dixon	-

STANDARD INFORMATION SHEET

Project (Installation) Name:	Edradour Area Development
DECC Reference number:	D/4149/2012
Type of Project:	Development of one or more gas-condensate fields with subsea wells, manifolds, pipelines and an umbilical.
Undertaker name:	TOTAL E&P UK Ltd
Undertaker address:	Crawpeel Road Altens Industrial Estate Aberdeen AB12 3FG
Licensees/Owners:	TOTAL E&P UK Ltd (75%) DONG E&P (UK) Ltd (25%)
Short description:	Edradour is a gas-condensate discovery located in Block 206/4 of the UK continental shelf, approximately 56 km northwest of the Shetland coast. The reservoir will be developed by completion of the existing Edradour exploration well (206/4-2) as a production well. This well will be connected to a new 4-well manifold and production tied-back to the existing Laggan-Tormore production flowlines by a new subsea Edradour production flowline. New pipelines for provision of monoethylene glycol (MEG, hydrate inhibitor) and service fluids to Edradour will be connected to the Laggan-Tormore MEG and service pipelines. Control of the Edradour facilities will be by a new umbilical from the Laggan subsea manifold. As part of the wider Edradour Area Development, a further three wells may be drilled targeting separate prospects. Each of these wells will be drilled from locations immediately adjacent to the existing 206/4-2 well. If successful, these wells would each be completed with Xmas trees, connected to the Edradour manifold and produced through the Edradour facilities. The water depth at the Edradour drill centre is approximately 295 m with the planned connection to the Laggan-Tormore flowlines at 385 m water depth. This Environmental Statement presents the findings of an assessment of the environmental impacts of the completion of the 206/4-2 well, installation of the Edradour facilities and the drilling, completion and connection of up to three further wells.
Key Dates:	First drilling 2013; Subsea structures, flowlines and umbilical installation 2014 – 2015; and First gas 2015.
Significant environmental impacts identified:	None.
Statement prepared by:	TOTAL E&P UK Ltd and Xodus Group.

NON-TECHNICAL SUMMARY

S1 INTRODUCTION

S1.1 EDRADOUR AREA DEVELOPMENT

Total Exploration & Production UK Ltd (TEPUK) and its partner DONG Energy (UK) Ltd (DONG) are planning to develop the Edradour field in UK continental shelf (UKCS) Block 206/4 to produce gas-condensate. Other potential gas-condensate reservoirs have also been identified for possible development within the same licence block. The completion of the existing Edradour well, drilling of up to three further wells and installation of facilities for the production from Edradour and these other prospects forms the Edradour Area Development described in this Environmental Statement.

The Edradour Area is located approximately 56 km northwest of the Shetland coast and 96 km from the UK/Faroe transboundary line, with the drilling locations at approximately 60°56'05"N, 2°13'51"W (Datum ED50) in water depths of approximately 295 m (Figure S1).

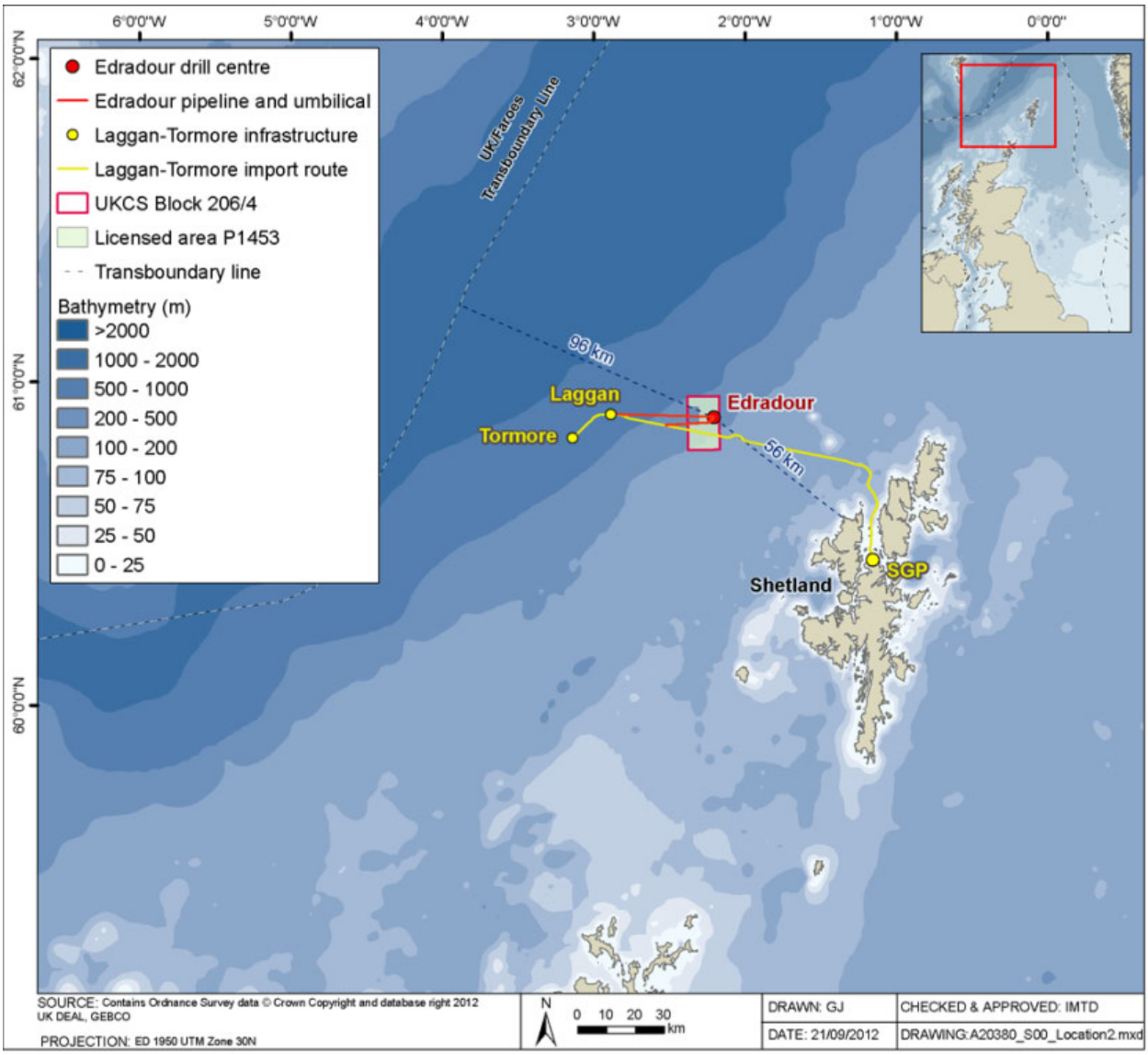

Figure S1 Edradour Area Development location

The Edradour Area gas-condensate will be produced through the Laggan-Tormore subsea facilities and the Shetland Gas Plant (SGP) that are currently being installed by the TEPUK-operated Laggan-Tormore project.

An Environmental Impact Assessment (EIA), as reported in this Environmental Statement (ES), has been

carried out in accordance with the requirements of the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999. The regulations require the undertaking of an EIA and the production of an ES for certain types of offshore oil and gas developments likely to have a significant effect on the environment. The ES considers impacts from the following (see Figure S2):

- The completion of the single Edradour well (206/4-2) as a production well;
- The installation of the Edradour manifold on the seabed next to the Edradour well;
- The installation of a 17 km Edradour production flowline, monoethylene glycol (MEG) pipeline and service pipeline between the Edradour manifold and the Laggan-Tormore production pipeline system. The tie-in point will be the In-Line Tee 3 (ILT3) on the Laggan-Tormore subsea pipeline system;
- The installation of a 35 km control umbilical from the Laggan manifold to the Edradour manifold;
- Installation of any pre-lay rock carpet and post-lay rock berm that may be required for the stability and protection of the pipelines and umbilical;
- The drilling of up to three additional wells at the Edradour drill centre, including well tests on two of the wells, and if successful their completion and tie-in to the Edradour manifold; and
- Alterations made to the SGP onshore.

S1.2 PROJECT SCHEDULE

The facilities to develop the Edradour field are planned to be installed in 2014 and 2015, with completion of the existing Edradour well in the first half of 2015 and production start-up targeted for late 2015. One of the other wells, named Prospect A, is currently planned to be drilled in 2013. If successful, it is proposed that a rig would be mobilised to complete the well in 2016 with tie-in to the Edradour manifold made at this time. The shallow sections of another well, named Spinnaker, were drilled in Q3 2012 (the consent for this was obtained under a separate application, but the impact is also considered in this ES). Further drilling of this well followed by well testing is planned in 2013. Completion and tie-in (if the well is a successful discovery) is proposed in 2016. Timing of drilling the potential future fourth well has not been determined. The lifespan of the Edradour Area Development is expected to be in the order of 15 years.

S1.3 THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

An EIA is a process designed to identify, interpret, predict and communicate information about the impact of proposed developments. The completion of an EIA is a legal requirement for projects of this type. The Environmental Statement (this document), is the documented outcome of this process; however, elements of the process continue through the development of the project and into operation through TEPUK's Environmental Management System (EMS). As the project progresses through detailed design, construction, installation and subsequent operations, environmental assessment will be on-going. The outcome of EIA and those final decisions still to be made will be reported in the appropriate detailed consent submissions to the Department of Energy and Climate Change (DECC) and other regulators as appropriate. An overview of the EIA process is provided in Figure S3.

Central to a pro-active environmental assessment is the requirement to identify issues that could have an impact on the environment and potential cumulative impacts. Once identified, these issues have to be assessed to define the level of potential risk they present to the environment, so that possible measures can be taken to remove such risk through design or operational measures (known as mitigation measures).

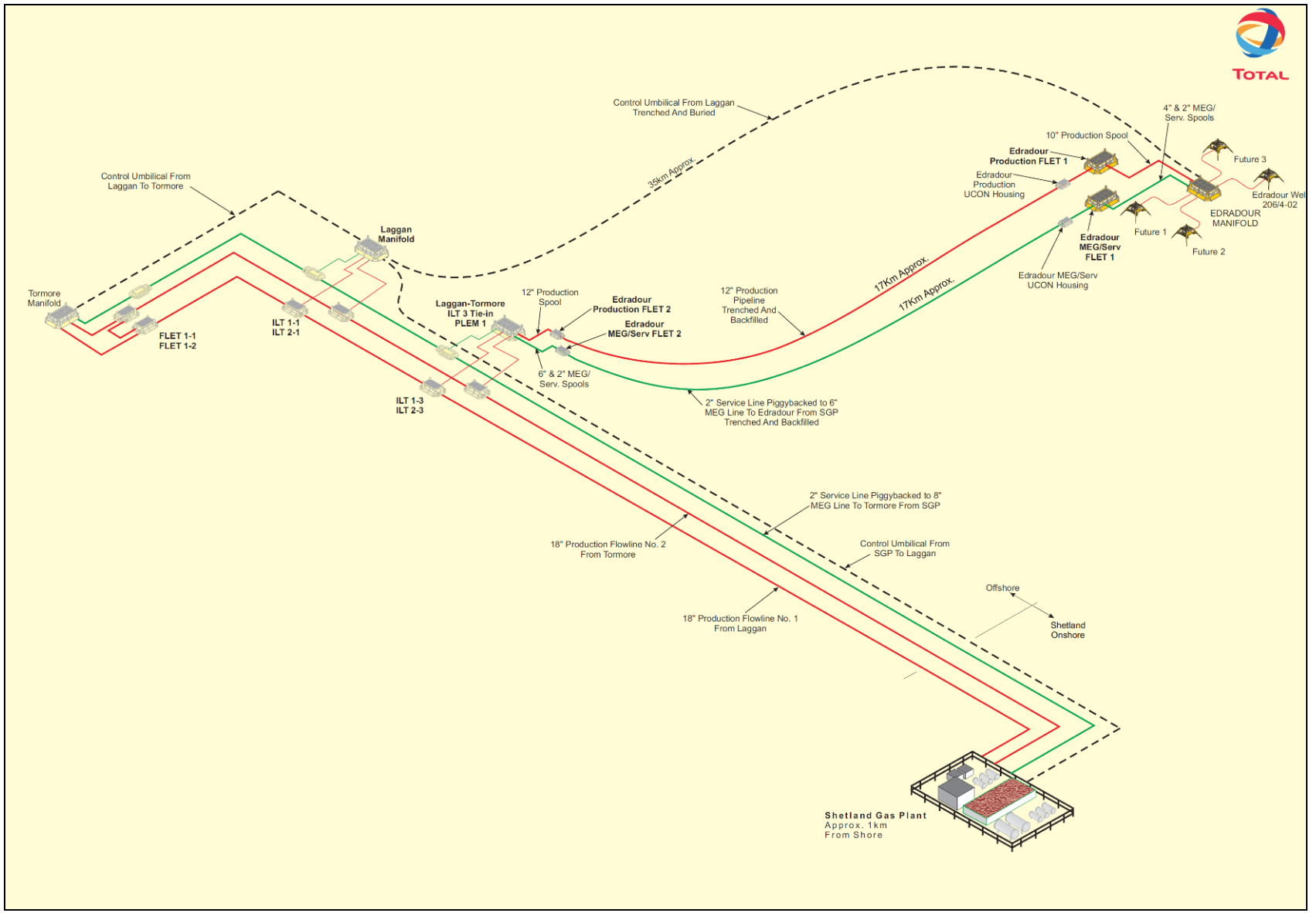

Figure S2 Edradour Area Development schematic

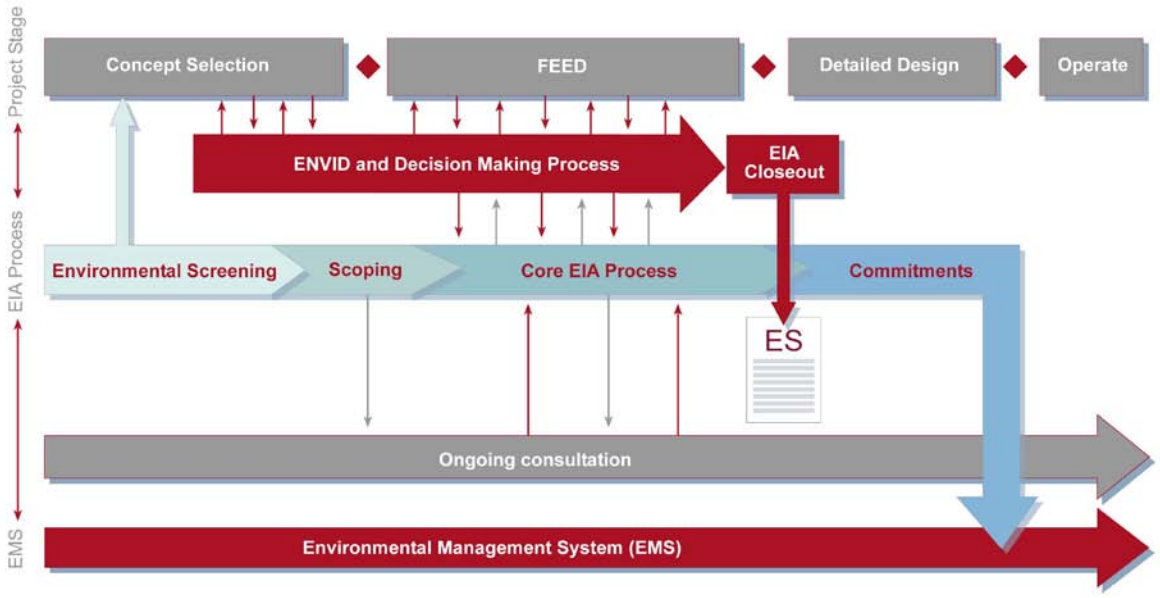

Figure S3 EIA process

S1.4 CONSIDERATION OF ALTERNATIVES

A key element of the EIA process is the consideration of alternatives prior to selecting the preferred option; this ensures that the environmental impacts and benefits of different options are fully explored, taking into consideration safety, operability and cost issues.

Within the west of Shetland area, the only direct gas processing and export route to the UK market is the Shetland Gas Plant (SGP) and Shetland Island Regional Gas Export (SIRGE) pipeline. All development options considered for the Edradour Area were therefore based on connecting to this infrastructure. The relative size and the composition of the Edradour Area reservoirs is such that a surface based facility (e.g. a production platform) producing export quality gas for direct export to the SIRGE pipeline was not considered to be economically viable or to offer any technical advantage, and so all options were based on the subsea tie-back of production to the SGP, either directly or through the Laggan-Tormore pipelines.

The main routing options considered for the Edradour Area Development were:

- 17 km Edradour production flowline to In-line tee 3 (ILT3);
- 10 km Edradour production flowline to Hot-Tap Tee 1 (HTT1); and
- 91 km Edradour production flowline directly to the SGP.

Subsea tieback to the Laggan-Tormore flowlines at either ILT3 or HTT1 was preferred in comparison to the direct tieback to the SGP because these options avoid the need to route a further pipeline through Yell Sound and Orka Voe. A tie-back to ILT3 or HTT1 has a smaller environmental impact than a tie-back to the SGP.

Following further evaluation, a production tie-back to ILT3 was then selected in preference to HTT1 as the downhill sloping route from Edradour to ILT3 is technically better than the uphill sloping route to HTT1 and ILT3 is provided with valves which the Edradour production flowline can be connected to.

The Laggan-Tormore Development uses continuous injection of MEG to prevent hydrates forming in the fluids during transportation to the SGP. The Edradour Area Development wells must also use this method to be compatible with Laggan-Tormore fluids during commingled transport to the SGP. ILT3 was selected for the MEG tie-in as it allows a parallel route for the MEG pipeline to the Edradour manifold alongside the new production flowline and it has an available valved connection.

Subsea control options considered for Edradour were:

- Extension of the Laggan-Tormore control system via a new umbilical from the subsea Laggan template-manifold structure to Edradour; or
- Provision of a new dedicated umbilical from the SGP to Edradour.

Technical studies showed that it is feasible to extend the Laggan-Tormore control system to Edradour through installation of a new umbilical from Laggan. Minor modifications will be required at the SGP for this, within the footprint of the existing facilities. This option was selected in preference to a dedicated umbilical from the SGP because it has a lower cost, avoids the requirement for earthworks at the SGP and avoids installation of an umbilical through Orka Voe and Yell Sound (therefore with less potential for negative environmental impact).

Several options were considered for the subsea architecture at the Edradour well location, considering the development of Edradour and the other prospects that may be tied-in as part of the Edradour Area Development. A 'cluster manifold' scheme was selected, where the manifold is installed on the seabed next to the existing Edradour well and each of the additional three wells proposed are drilled from top-hole locations close to the manifold (Figure S2). This means that the subsea infrastructure is less complicated and has a reduced seabed footprint in comparison to other technically viable options.

S2 THE DEVELOPMENT

S2.1 RESERVOIR CHARACTERISTICS

The Edradour fluids are predicted to be a light gas-condensate with a condensate-gas ratio of approximately 11 barrels per million standard cubic feet based on a direct flash of reservoir fluids to standard conditions (of 60°F and atmospheric pressure). The reservoir fluid contains approximately 5.5 vol% carbon dioxide.

S2.2 WELLS AND DRILLING

Given the harsh environment experienced to the west of Shetland, the Edradour Area Development wells will be drilled from a drill ship or semi-submersible drilling rig which has been designed to withstand the ocean conditions.

Semi-submersibles are floating rigs that provide a stable platform to allow drilling into the sea floor. They maintain station either by the use of a dynamic positioning system (thrusters) or through the placement of anchors onto the seabed.

Up to four wells are considered within the scope of this ES. The drilling-related activities are:

- Re-entry and completion of the Edradour exploration well (206/4-2); and
- Drilling and completion of two further wells, named Spinnaker and Prospect A, adjacent to the Edradour exploration well, and one possible future well, also in the same approximate location.

The three additional wells will be deviated from their top-hole locations using directional drilling techniques in order to reach the reservoir targets, and will therefore be S-shaped in profile. The wells will be drilled using drilling muds to cool the rotating drill bit, lubricate the drillpipe as it turns in the well bore, carry rock cuttings to the surface and prevent the wall of the borehole from collapsing. It is anticipated that water based mud (WBM) will be used for the drilling operations and that WBM and any associated cuttings will be discharged to sea. It is expected that a maximum of 2,215 tonnes of WBM and cuttings would be discharged to the marine environment for each well (up to a total maximum of 6,645 tonnes for all three wells). For the shallower stages of the well, this would occur directly to the seabed around the well. For deeper sections, a closed circulation system would be used, whereby WBM and cuttings are returned to the rig for processing prior to overboard discharge. These overboard discharges will descend through the water column and be spread more thinly over a wider area of seabed.

Vertical seismic profiling (VSP) is a survey technique using the reflected sound signals from air guns to establish the geological structure of the formations through which the well passes, which adds to the information available from previous wider scale seismic survey data. It is expected that VSP operations may be required for the three additional wells in the Edradour Area.

S2.3 SUBSEA STRUCTURES

An overtrawlable protection structure will be installed for each of the wells (over the wellhead and Xmas tree). The wells will be connected by short sections of pipeline (known as jumpers) to the centrally located Edradour manifold. The Edradour manifold will also be designed to be overtrawlable to provide protection from dropped objects and fishing gear interaction.

A number of additional subsea structures will be installed between the Edradour manifold and the ILT3 tie-in. These include flowline end termination units (FLETs), a pipeline end manifold (PLEM) at ILT3 and a possible cooling spool structure at the Edradour location that may be required for cooling of the produced fluids before they enter the production pipeline.

S2.4 PIPELINES

Production fluids from the Edradour manifold will be transported through a new 17 km pipeline to the ILT3 tie-in point.

MEG will be supplied to the Edradour Area wells via a new 17 km pipeline from the ILT3 tie-in point on the Laggan-Tormore MEG pipeline. The service line functionality included in the Laggan-Tormore system will also be extended to Edradour using a small service pipeline (piggy-backed on to the MEG pipeline), also connected to the ILT3 tie-in point.

Control of the Edradour Area facilities will be provided by installing a new 35 km umbilical from the Laggan manifold to the Edradour manifold. The umbilical will provide the hydraulic, electric and fibre optic services required by Edradour Area facilities along with cores for chemical treatment (scale and wax inhibitor).

The initial intention for the installation of the pipelines was that the Edradour production flowline, MEG and piggy-backed service pipelines and the umbilical would be trenched and buried. However, based on the experience gained during design and installation of the Laggan-Tormore pipelines in this area, this may not be possible due to the presence of seabed boulders. An alternative option of using rock protection, both underneath and on top of the pipelines and umbilical has therefore been assessed in this ES, as it constitutes the solution with the greatest potential environmental impact. The installation of the pipelines would involve the use of a rock dump vessel to install a rock carpet on the seabed, upon which the pipelines would be placed using a pipelay vessel. Following pipelay, further rock would be placed on top of the pipelines for protection and stabilisation purposes. The final installation solution will be determined from 2012 survey data and on-going engineering work.

S2.5 EXISTING FACILITIES AND MODIFICATIONS

The Laggan-Tormore pipelines were designed to allow future developments in the west of Shetland area to easily make use of the infrastructure they will provide. As such, only relatively minor work to remove sections of the existing protection structures over the ILT3 tee and valve assembly, make up tie-in piping to the ILT3 PLEM, and replacement of the protection structure sections is required.

As the produced fluids from the Edradour Area Development will be broadly similar to those from Laggan-Tormore, only small modifications to the SGP are necessary. The main requirements will be for modification of the SGP controls infrastructure to cater for the new Edradour Area facilities and installation of mercury removal equipment due to the expected presence of small amounts of mercury in the Edradour Area fluids. No additional groundwork (e.g. clearance, peat storage, concrete pads, etc.) is required to install the proposed mercury removal equipment as the space for this is already reserved and will be adequately prepared as part of the on-going SGP construction works.

Produced water from the Edradour Area Development will be commingled with Laggan-Tormore produced water. The total produced water from Laggan-Tormore and the Edradour Area will be within the existing capacity of the effluent water treatment systems at SGP, and so Edradour Area production will not increase the SGP effluent water discharge flowrate from that assessed under the Laggan-Tormore development.

No new chemical types are expected to be used during the operational phase of the Edradour Area Development, but there may be an incremental increase in the use of the same chemicals used in the Laggan-Tormore Development. To align with this, a variation to the SGP Pollution Prevention and Control (PPC) permit will be undertaken prior to production, to cover additional chemical requirements.

It is not expected that the Edradour Area Development will result in increased power use at the SGP.

S2.6 COMMISSIONING ACTIVITIES

Well testing following drilling is a means of assessing reservoir performance by measuring flowrates and pressures under a range of flow conditions. A limited amount of fluid is allowed to flow from the formation being tested which, in the absence of export facilities, is usually disposed of through flaring. Well testing has already been carried out for the existing Edradour well but it is likely that well testing will be required for two of the three future Edradour Area wells, with the expectation that this will be through use of a retrievable Drill Stem Test string. Prior to running the string, the wellbore will be cleaned up from drilling mud to sea water. Each well test will have a duration of up to 96 hours, during which a maximum of 2,000 tonnes of produced hydrocarbons will be flared.

Prior to commencement of production, the following testing and pre-commissioning activities will occur for the pipelines, which will involve discharges to sea:

- Flooding the offshore pipelines with filtered and treated water (possibly seawater);
- Cleaning to remove any solid material from the pipeline and to prevent damage to valves and instrumentation, undertaken as part of flooding operation;
- Pipeline gauging to demonstrate that the pipeline is free of buckling, denting, etc.;
- Optional baseline intelligent pigging (internal pipeline inspection using a remotely controlled device) of the pipelines, to provide benchmark data for comparison with future inspections;
- Strength test of the as-installed offshore pipelines;
- Leak test of entire system once fully tied-in; and
- De-watering, to remove all water from pipelines prior to the introduction of normal service fluids.

S2.7 OPERATION AND MAINTENANCE

The offshore Edradour Area Development facilities will be operated remotely from the SGP. Actuated valves will be opened and closed through the subsea control system and small volumes of hydraulic fluid will be discharged to sea during these operations.

No workovers are anticipated on the Edradour Area wells, but logging or a light intervention may be undertaken. It is anticipated that there will be one such event for each of the four wells during field life.

Operational pigging of the Edradour production flowline is not anticipated to be required. However, facilities will be available for installation of a subsea pig launcher and receiver to complete inspection pigging. Any inspection pigging operation will require support from surface vessels.

S2.8 DECOMMISSIONING

The infrastructure associated with the development will be decommissioned when operations are no longer economically viable. The lifespan of the Edradour Area Development is expected to be in the order of 15 years. Within this time frame there may be changes to the statutory decommissioning requirements as well as advances in technology and knowledge. TEPUK will therefore aim to utilise best recognised environmental practice during all decommissioning operations in line with legislation and guidance at the time.

In advance of the decommissioning process an inventory of all project equipment will be made and an examination for further reuse will be carried out.

S3 ENVIRONMENT

S3.1 PHYSICAL ENVIRONMENT

The west of Shetland area, within which the Edradour Area Development is located, is characterised by persistent, long-period swells, complex current regimes and rapidly changing weather conditions. The deep water over the edge of the continental slope west of Shetland is exposed to a large fetch and strong winds, particularly from the west and southwest. These conditions generate an extreme wave regime in the area, which is more severe than that experienced in the northern North Sea.

Winds can occur in any direction in the vicinity of the Edradour Area Development, but the predominant winds throughout the year are from the south and west. The dominant wind speeds throughout the year are moderate breezes. Strong winds can occur throughout the year, but are more frequent during the winter months.

The Edradour Area Development is located on the shelf break of the west of Shetland continental shelf and upper part of the continental slope (eastern flank of the Faroe-Shetland Channel). The Edradour drill centre is located in a water depth of approximately 295 m. The proposed pipeline and umbilical routes are located in water depths ranging from 295 m at Edradour to 385 m at the ILT3 tie-in and 590 m at Laggan.

TEPUK has undertaken a number of surveys west of Shetland in support of both the Edradour Area Development and the Laggan-Tormore Development.

A survey conducted by Fugro (2009a) at Edradour reported the seabed sediments to consist of a thick layer of sand, with the sand deposits thought to be mobile due to local seabed currents. Areas of sand ripples, as well as areas of coarse sediment comprising pebbles, cobbles, silt and clay were also reported around the Edradour area.

A survey conducted by Fugro (2012a) between Edradour and ILT3 reported the seabed sediments to consist of very soft to soft well layered pebbly clay with occasional gravel layers within the deeper western part of the proposed corridor, and soft to stiff sandy clay with occasional gravel, sand layers and boulders within the eastern part of the proposed corridor. Numerous possible boulders were observed within the proposed corridor between Edradour and ILT3.

Between Edradour and the proposed umbilical tie-in at Laggan, a very similar pattern of sediment distribution to the Edradour to ILT3 route was noted (Fugro, 2012b), although some sample stations showed sediments that were generally coarser in nature. The main difference was the presence of occasional seabed mounds (raised features on the seabed formed by deposition of boulder and sand material).

S3.2 BIOLOGICAL ENVIRONMENT

Plankton

Plankton forms the basis of much of the marine food web. The composition and abundance of plankton communities varies throughout the year and is influenced by physical parameters such as temperature, salinity and water inflow. In the northeast Atlantic, species of a single-celled plant group known as dinoflagellates, especially *Ceratium,* dominate the phytoplankton community. The small crustacean *Calanus* is of particular importance in the zooplankton in the vicinity of the Edradour Area Development. Large populations of pre-adult *Calanus finmarchicus* over-winter in the cold deep waters of the Faroe-Shetland Channel, migrating to surface waters during the spring where they are circulated into the North Sea by prevailing currents. During autumn, water currents return *C. finmarchicus* to the west of Shetland area where they sink down to the deeper waters to over-winter once again.

Benthic communities

With regard to animals living on the seabed and visible to cameras (epifauna), the areas of sand around the Edradour drill centre are characterised by a mobile and not very diverse range of species including occasional hermit crabs, pencil-spined sea urchins (*Cidaris cidaris*) and sea cucumbers (*Parastichopus tremulus*) (Fugro, 2009a, 2012a, 2012b). The invertebrate community living and burrowing within the sediments (infauna) is dominated by worms, with fewer numbers of crustaceans, molluscs and echinoderms (e.g. starfish, sea urchins). In sediment samples taken, the most abundant infaunal species overall are the tube-dwelling worm *Galathowenia oculata*, the tube-dwelling anemone *Cerianthus lloydii*, and the burrowing worm *Aonides paucibranchiata*.

This sediment type and seabed community extends to the west from the drill centre along the first 10 km of the pipeline route towards ILT3. However, along this route, the dominant seabed type changes to silty fine to medium sand, with gravel, pebbles, cobbles and shell fragments (i.e. mixed sediment), rockier elements of which are of potential conservation interest (see Section S3.3). Mobile surface-living animals observed included the pencil-spined sea urchin (*Cidaris cidaris*), sea cucumber (*Parastichopus tremulus*), starfish (including *Henricia oculata*), feather stars, hermit crabs, squat lobsters and molluscs. In addition, several non-mobile or attached forms such as the anemone *Bolocera*, occasional sponges and bryozoans (or sea mats) were also observed.

On the umbilical route between Edradour and the tie-in at Laggan three habitats were identified. Two of

these were the same as observed on the pipeline route and around the drill centre, described above. The third was a community characterised by a high diversity and density of sponges (which are of potential conservation interest; see Section S3.3), including branched forms such as *Antho dichotoma*, chalice sponges (*Phakellia*), globose sponges and encrusting sponges. This sponge habitat was found in similar sediments on the remainder of the umbilical route but ROV footage showed a greater proportion of coarser sediments in these areas (including cobbles and small boulders). The species recorded also included a number of brittle stars (which appeared to use the sponges as elevated perches), feather stars, squat lobsters (*Munida*) and the coral worm *Filograna implexa*. Fish species recorded in this biotope included a rabbit fish (*Chimera monstrosa*) and an unidentified ray.

Fish populations

A number of commercially important fish species are encountered in the vicinity of the Edradour Area Development (e.g. saithe, anglers, mackerel, cod). Norway pout is the only commercially important species that spawns in the area of interest (Coull *et al*., 1998, Ellis *et al*., 2010). Norway pout, mackerel, cod, common skate, hake, sandeel, spurdog, anglerfish, ling and blue whiting also use the waters around the Edradour Area Development as nursery grounds throughout the year (Coull *et al*., 1998, Ellis *et al*., 2010).

Seabirds

Much of the UK coastline and offshore waters are internationally important breeding and feeding habitats for seabirds. The distribution of seabirds in the vicinity of the offshore Edradour Area Development changes throughout the year, with the lowest numbers being present in the summer months during the breeding season when seabirds tend to be located inshore at breeding colonies. Generally, however, in the vicinity of the Edradour Area Development, the northern fulmar is the most abundant species, whilst black-legged kittiwake, Atlantic puffin and common guillemot occur in moderate to high densities. Seabirds, as with other marine life, can be affected to some degree by offshore activities, including those potentially resulting in oil spills. This vulnerability has been quantified for offshore areas on a monthly basis using the seabird vulnerability index (JNCC, 1999); this index suggests that the period of highest vulnerability within the Edradour locality is in February, March, May and July.

Marine mammals

The west of Shetland area is regarded as an important area for cetaceans (whales and dolphins) in a national and international context. A total of fourteen different species are regularly detected to the west of Shetland, with several of these species using these waters during migrations. The most abundant cetacean in the area to the west of Shetland is the Atlantic white-sided dolphin, followed by fin and sei whales.

The grey and harbour seal are resident breeding species in the Western Isles, Orkney and Shetland and may be encountered in the vicinity of the Edradour Area Development, albeit in low numbers. Hooded seals breed and moult on the packed ice of Arctic waters and, although on the edge of their territory, it is likely that they will be encountered in the vicinity of the Edradour Area Development, albeit also in low numbers.

S3.3 CONSERVATION

The JNCC has been commissioned by the UK government to identify areas that may qualify as possible offshore Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) under the EU Habitats Directive (92/43/EEC as amended 97/62/EC). No designated offshore conservation sites are present in the vicinity of the Edradour Area Development. The closest identified site is the Wyville Thomson Ridge, located approximately 232 km to the southwest.

In addition to SACs in Scottish waters, new Marine Protected Areas (MPAs) can now be designated and protected through the Marine and Coastal Access Act 2009 (MCAA) and the Marine (Scotland) Act 2010. The Edradour Area Development sits within the approximate extent of the Faroe-Shetland sponge belt Marine Protected Area (MPA) search location. This search area, which confers no specific protection at this stage, has been identified due to the presence of Atlantic-influenced sediments and previous records of diverse deep sea sponge aggregations in the region (which could fall within the definition of the OSPAR priority habitat 'Deep-sea sponge aggregations').

An assessment was undertaken on the potential stony reef habitat (sediments with cobble or boulder sized coarse material) recorded along the pipeline and umbilical routes. All but one of the stations sampled had low potential for qualifying as stony reef in terms of cobble and boulder composition; elevation above the surrounding seabed; and extent of cover by colonising species (Fugro, 2012a, 2012b). The one remaining

station, located in the deeper half of the umbilical route, was built up to a greater height above seabed than the other stations investigated, and it was classed as having moderate 'reefiness'. The results of this survey work and habitat assessment suggest that whilst the area may host rock habitats and associated fauna, the extent of any such habitat is extremely restricted and the seabed on which the development will be located does not comprise high quality rocky reef habitat of significant conservation concern under the EU Habitats Directive.

'Deep sea sponge aggregations' were identified along the proposed umbilical route between Edradour and Laggan at water depths between 460 and 550 metres. The greatest density was 10 to 15% at approximately 517m (Fugro 2012b). The presence of these relatively diverse communities in which sponges were prominent is in line with the published literature on these habitats and the deep sea sponge aggregations recorded at similar depths during the 2007 Laggan pipeline route survey (Fugro 2007), south of the proposed Edradour umbilical route. However, the sponge communities observed during the umbilical route survey (Fugro, 2012b) and past Laggan surveys (e.g. Fugro, 2007) all lacked the massive geodid sponges that are characteristic of the northeast Atlantic deep sea sponge communities, indicating that although the Edradour Area Development sits within a wider area of potential conservation interest for sponge aggregations, the seabed that the proposed development will occupy does not host such aggregations.

The northwest coast of Shetland is the closest land point to the east of the Edradour Area Development, at a distance of approximately 56 km. Shetland is comprised of a large number of islands and skerries with many coastal habitats being designated as sites of national, European and international importance. The cliff coastline supports internationally and nationally important populations of breeding seabirds and, as such, a number of sites have been identified as SACs, Ramsar sites, SPAs (including some areas for which extended marine boundaries have been proposed), National Nature Reserves and National Scenic Areas.

S3.4 HUMAN ENVIRONMENT

Commercial fisheries

The Edradour Area Development is located within ICES fishing area IVa and ICES rectangle 50E7. A fishing intensity study for the Edradour Area concluded that the majority of fishing activity in the close vicinity is reported as Scottish vessels of over 15 m length using demersal (fish captured at or close to the seabed) gear. However, the pattern of activity appears to be correlated with water depth and suggests that most of the fishing activity along the Edradour pipeline and umbilical route may not actually be with demersal gear. Fishing in the offshore west of Shetland area generally occurs across the shelf, but intensity is greatest within the 200 to 500 m depth band where the shelf turns into slope. In 2011 a total of 2,558 tonnes of pelagic (fish captured in the water column away from the seabed), demersal and shellfish species were captured in the vicinity of Edradour by Scottish based vessels with a value of £4.1 million. The total relative value of the area is categorised as moderate in comparison with the rest of UK waters and the relative effort is categorised as low.

Other Sea Users

There is a long history of oil and gas activity north and west of Scotland, with the first well being drilled in 1972. Recently, the development of the Laggan and Tormore gas fields has been approved, with drilling operations starting in 2012. In addition, there are a number of other recent finds and on-going appraisals to the west of Shetland.

The shipping levels in the waters to the north of Scotland are relatively low when compared with parts of the English Channel and North Sea.

There are no submarine cables, designated wrecks or military practice areas in the vicinity of the Edradour Area Development.

S4 SEABED IMPACTS

A number of drilling and installation activities that will be conducted during the Edradour Area Development have the potential to impact the seabed. In addition, a number of structures will be placed on the seabed for the life of the development. The key activities that may interact with the seabed are:

- Infrastructure installation
  - Installation of the production flowline, MEG/service pipelines and umbilical including rock protection; and
  - Installation of the Edradour manifold, PLEM, cooling spool structure and FLETs.
  - Installation of wellhead protection structures on the seabed.

- Drilling
  - Anchoring/placement of the drilling rig; and
  - Deposition of drill cuttings and drilling muds onto the seabed (this impact is covered in Section S7).

The above activities have the potential to lead to changes in the seabed, which would have positive or negative impacts on the biota of the region, including:

- Direct physical injury;
- Smothering or clogging of communities through sediment re-suspension;
- Loss of habitat; and
- Habitat modification.

The placement of the structures and pipelines on the seabed, together with their stabilisation and protective rock and mud mats, will result in a number of impacts on the seabed including:

- Long-term loss of seabed habitat directly beneath the infrastructure and rock dump to be installed;
- Temporary indirect disturbance through the suspension and re-settlement of sediments around the footprint periphery during the installation activities; and
- Introduction of a new hard substrata habitat through the installation of rock dump material and subsea structures.

The placement of the anchors and chains onto the seabed for drilling rig operations has the potential for direct displacement and abrasion of the habitat area under each anchor and chain.

TEPUK aims to ensure that the seabed impacts are minimised as far as possible, and will employ a number of mitigation measures including: using a controlled fall pipe vessel during rock placement activities to ensure accurate placement of material and the formulation of a detailed anchor pattern for the drilling rig prior to mobilisation and re-use of the same anchor patterns for rig visits where possible.

Biological communities are in a continual state of flux and are able to either adjust to disrupted conditions or rapidly re-colonise an area that has been disturbed, or a new surface that has been introduced. The dynamic nature of the seabed environment will aid with the recovery of the disturbed areas, although some seabed impacts may persist in the short to medium term e.g. anchor scars.

No areas of significant conservation importance are present in the areas that will be impacted by the Edradour Area Development. Although it is expected that the development will have some impact on the seabed in general, the adoption of suitable mitigation measures and best practice approach to installation would mean that any residual risks associated with the Edradour Area Development are not considered to be significant.

S5 NOISE IMPACTS

Noise is readily transmitted underwater and there is potential for the sound produced by oil and gas activities to cause detrimental effects to marine mammals. The introduction of additional noise to the marine environment could potentially interfere with the ability of these animals to determine the presence of predators, food and underwater features and obstructions. It could therefore cause short-term behavioural changes and at distances very close to the source, physical damage.

There are a number of activities planned as part of the Edradour Area Development which are likely to involve noise emissions of varying scale:

- Drilling;
- Vessel movements, including the possible use of a dynamically positioned (DP) drilling rig;
- Vertical seismic profiling (VSP) at up to three wells; and
- Potential piling of the Edradour manifold and PLEM (subject to the foundation design required).

Although a number of cetacean species do frequent the development area, none of them are expected to be in present in high numbers, and the area is not considered to be of high importance in terms of reproduction or marine mammal residency.

A range of measures will be applied to reduce noise impacts, which are likely to include:

- Qualified and experienced Marine Mammal Observers (MMO) will be present for the duration of VSP and piling operations and will undertake cetacean visual monitoring during all daylight hours;
- Passive Acoustic Monitoring (PAM), the use of hydrophones to detect, monitor and, in some cases locate, vocalising marine mammals, will be used for noisy operations at night-time and during periods of low visibility (e.g. fog) to detect any cetaceans within close proximity to the VSP or piling operations; and
- VSP or piling operations will be delayed if cetaceans are detected within 500 m of the rig/VSP survey vessel or pile driving hammer, and until cetaceans have moved away (not sighted or detected for at least 20 minutes).

S6 ATMOSPHERIC EMISSIONS

Consideration has been given to all potential sources of atmospheric emissions associated with the Edradour Area Development. Emissions arising from installation and commissioning activities include those from:

- Drilling rig;
- Well test operations; and
- Installation and support vessels

The emissions produced from the installation and commissioning activities offshore have the potential to contribute to a variety of environmental effects including global warming (greenhouse gases), acidification (acid rain) and local air pollution. Localised impacts may include elevated levels of atmospheric emissions in the immediate area of the vessels. The dispersive nature of the environment offshore and the lack of human receptors in the vicinity of the Edradour Area Development is such that locally elevated concentrations of combustion products will be short-lived and are unlikely to result in significant environmental impact.

All vessels employed during drilling and installation activities will comply with relevant merchant shipping regulations which will ensure the levels of pollutants entering the atmosphere are minimised. All combustion equipment will be subject to regular monitoring and inspections to ensure an effective maintenance regime is in place, ensuring all combustion equipment runs as efficiently as possible.

The contribution to total annual UKCS emissions from drilling, well testing, subsea infrastructure installation and pipelay from the Edradour Area Development is very small (total Edradour Area Development emissions from these activities being approximately 0.33% of the annual UKCS emissions).

It is not anticipated that production from the Edradour Area Development will result in a significant increase of emissions at the SGP because overall production through the SGP will be within the current capacity of the plant. The quantity of emissions from fuel gas will increase very marginally because of the higher carbon dioxide concentration in Edradour Area gas than in the other (Laggan-Tormore) gas processed at the SGP (requiring slightly more fuel gas to produce the same amount of power).

The release of greenhouse gases into the environment from the Edradour Area Development and their contribution to global warming will be negligible or minor in relation to those from the wider offshore industry and outputs at a national or international level. No significant cumulative effects are envisaged.

S7 DISCHARGES TO SEA

Through the drilling, installation, commissioning and operational phases of the Edradour Area Development there are a number of potential discharges to sea:

- Vessels
  - Drainage;
  - Sewage; and
  - Black water discharges.
- Drilling discharges
  - Mud and cuttings;
  - Cement; and
  - Clean-up and completion chemicals.
- Commissioning discharges
  - Pipeline commissioning.
- Operational discharges
  - Produced water discharges.

Those discharges associated with vessel operations (e.g. sewage) are considered to have only a negligible environmental impact.

All relevant legal permits will be in place prior to operation.

Within the immediate vicinity of the wells, the discharge of permitted cuttings, mud and cement during drilling activities will alter the seabed topography and sediment structure. The accumulation of drill cuttings, drilling mud and cement at the drilling location is likely to change the seabed community in the immediate area by burying some animals and impairing the feeding and respiration of others. In addition, although mud and cuttings discharge may result in detectably elevated concentrations of some metals in seabed sediments within a few hundred metres of the drill centre, measurable biological impact from such activities is limited and generally restricted to within approximately 50 m of the drilling activity (e.g. Neff, 2005). Therefore at the Edradour drill centre, it is likely that the the net effect will be that measurable modification to benthic communities will be restricted to within approximately 50 m of each well; in effect this means in a radius of approximately 100 m of the central manifold around which the wells are clustered. From survey work, none of the habitats, species or communities occurring around the drill centre qualify as priority marine features or represent features of conservation interest under the Habitats Directive or UKBAP.

Produced water from the Edradour Area will be processed at the SGP, within the capacity of the existing effluent water treatment system design. Edradour Area production will not increase the effluent water discharge flowrate from that assessed under the Laggan-Tormore development.

No significant or cumulative transboundary impacts are expected from the forecast production from the Edradour Area Development. The drilling footprint is not expected to overlap that from other developments.

S8 INTERACTIONS WITH OTHER SEA USERS

There will be an increase in the number of vessels that will be operating in the Edradour Area during drilling activities, such as the drilling rig and support vessels. This could result in loss of access to the area for other vessels on a temporary basis and increase the risk of vessel collisions. Anchor mounds that potentially could form from anchors used by the drilling rig, could pose a snagging risk to fishing vessels.

During pipeline and subsea infrastructure installation there will be considerable, although short-lived, vessel activity, especially along the pipeline and umbilical routes. These activities will also limit vessel access to areas along the routes and will present a collision risk to other sea users.

In addition to statutory requirements to mitigate this, TEPUK has established lines of communication to inform other sea users, including fishermen, of its offshore activities. Normal routes of communication will also be used to notify shipping of the presence of drilling and installation vessel activity, usually through the Notices to Mariners system.

To minimise interference with fishing, a safety zone will be established around the drilling rig and installation vessels whilst on location, and the location of the anchors and chains from the drilling rig that lie outside this safety exclusion zone will be communicated to other sea users. All subsea structures will be designed to be overtrawlable and the pipelines and umbilical will be protected along their entire length. The subsea

structures and any rock dumped pipelines/umbilical will be recorded on navigational charts.

The Edradour Area Development is located in an area of generally low shipping activity; consequently any increase in the risk of vessel collision as a drilling and installation activities will be neglible.

The access restrictions as a result of the Edradour Area Development to fishing will be localised and temporary in nature. Anchor mounds that could form will be temporary and are expected to flatten overtime. This, combined with the fact that fishing effort has been observed to have decreased in the wider area over the last three years, and that all subsea infrastructure including pipelines will be overtrawlable, means that the overall risk of significant interference to fishing activities is considered to be low.

S9 ACCIDENTAL EVENTS

All offshore oil and gas exploration, production and export operations carry with them some risk of accidental hydrocarbon or chemical spill. Potential sources include:

- Bunkering and cargo loading/handling (including mud handling) operations;
- Upsets in bilge treatment systems;
- Storage tank failures of lube oils, fuel oil, oil based muds, base oil and chemicals;
- Spill during maintenance activities including equipment removal and lubrication;
- Loss of well control during drilling;
- Damage sustained during a collision, grounding or fire;
- Overpressure rupture of pipelines;
- Corrosion of pipelines; and
- Structural failures of subsea equipment.

Prevention of pollution is a key TEPUK commitment, both through the EIA process and as an integral part of TEPUK's Safety, Health, Environment and Integrity Policy. It is a priority for the project planning, engineering, installation and operation. A number of spill prevention methods will be in place to reduce the likelihood of accidental hydrocarbon or chemical spills from the Edradour Area Development:

- Pre-mobilisation audits of vessels including a detailed list of contractual requirements in terms of spill (both oil and chemical) prevention procedures will be put in place;
- Environmental spill kits, including absorbent material, will be on board the rig and vessels to allow clean-up of any deck spills or leaks;
- Procedures will be put in place for chemical transfers in order to minimise the risk of spillage;
- Regular maintenance and inspection of equipment and high spill risk points;
- Pipelines will be designed to prevent/reduce corrosion;
- Where necessary, the pipelines will be protected by burial or with rock dump;
- Inspection pigging will be undertaken;
- There will be a 500 m safety exclusion zone around the drilling rig and other vessels whilst on location, to reduce the likelihood of vessel collisions;
- All vessels and the drilling rig will comply with industry codes for prevention of oil pollution and vessels will have on-board a Shipboard Oil Pollution Emergency Plan (SOPEP); and
- An Oil Pollution Emergency Plan (OPEP) will be in place for the drilling operations carried out by the rig, and for the operational phase of the Edradour Area Development;

Even with comprehensive prevention measures in place there is a residual spill risk and integral to offshore operations are detailed contingent spill response plans.

Oil spill modelling was carried out as part of this EIA to understand what might happen to released hydrocarbon in the worst case hydrocarbon spill and to help plan response strategies and actions. The hydrocarbons from the Edradour Area will be gas/condensate. The likelihood of a major incident occurring that would result in condensate polluting the sea surface (e.g. well blow-out or pipeline rupture) is remote. The Edradour condensate has a low density, it will not form emulsions and most will evaporate. Therefore in the event of a large spill it is unlikely to persist in the marine environment and impact the environmental sensitivities, such as seabirds or commercial fisheries. Two types of modelling were carried out on the worst case spill; deterministic (or trajectory) which predicts the route of the spill and how the condensate breaks down under specific extreme wind conditions, and stochastic which predicts the probability of oil occurring on the surface and the probability of it reaching a coastline using historic wind data. The deterministic modelling

predicted the condensate would not reach any shoreline in the event of a spill. Less than 0.01% of the condensate released was predicted to remain on the sea surface, the remainder having evaporated or dispersed. The stochastic modelling predicted that the probability of condensate reaching a coastline was generally less than 10%, though there was one small section of the Norwegian coast where there was a probability of between 5% and 60%. The predicted earliest a shoreline could be impacted after a spill is 13 ½ days. As the condensate disperses quickly the shoreline locations predicted include cases where either hydrocarbon is present on the sea surface, or dispersed within the water column. As such, some of these locations may not have visible hydrocarbon and only non-visible hydrocarbon in the water column. This is likely to result in a decreased environmental impact (such as the oiling of birds) relative to the presence of surface hydrocarbons at a shoreline.

The EIA process has identified the key environmental sensitivities related to oil spills, and the modelled behaviour of the Edradour condensate if spilt to sea has been used to develop an Edradour oil spill response plan. A detailed spill response strategy will be finalised for both drilling and production prior to the start of operations. TEPUK has a number of arrangements in place to ensure appropriate response to any spill scenario.

Given the low probability of an oil spill occurring, the non-persistence of diesel and condensate, appropriate management and mitigation procedures, and appropriate response procedures, the overall risk of environmental impact from a spill is considered negligible.

S10 WASTE MANAGEMENT

TEPUK is under a 'Duty of Care' to ensure that it handles all of its controlled waste safely and in compliance with the appropriate regulations. This also includes organisations that collect, transport or receive TEPUK waste. Measures to be adopted are based on the recognised waste 'hierarchy' and include:

- Waste should be prevented or reduced at source as far as possible (e.g. waste is designed out or packaging is reduced, the correct amount of materials are ordered);
- Where waste cannot be prevented, waste should be reused or refurbished and then reused as far as possible;
- Waste materials should be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material; and
- Where useful secondary materials cannot be reclaimed, the energy content of waste should be recovered and used as a substitute for non-renewable energy sources.

Edradour waste production will largely be generated during drilling, installation and commissioning operations both offshore and onshore. During the production phase, the most significant change in waste production at the SGP as a result of the Edradour Area development will be the periodic replacement of the mercury absorbent media used in the mercury removal unit.

TEPUK will develop a Waste Management Plan (WMP) for the Edradour Area Development. The plan will cover all stages of the project lifecycle and will be developed before project commencement. The plan will provide a structure for waste guidance and disposal at all stages during the project, including disposal of mercury contaminated materials.

All waste produced offshore from the development will be shipped to shore for disposal, or further use.

S11 ENVIRONMENTAL MANAGEMENT

TEPUK has established an independently verified Environmental Management System (EMS) which covers all production operations (Figure S4).

The EMS provides a framework to ensure compliance with environmental legislation, the prevention of pollution, and achievement of continuous improvement of environmental performance. The EMS is continually under review in order to adapt to changing statutory requirements, corporate aspirations and new/evolving scientific knowledge and techniques. The EMS achieved third party certification against the internationally recognised EMS standard ISO14001.

A Commitments Log has been developed for each aspect of the Edradour Area Development. This log summarises all mitigation and management measures identified during the EIA process, including where appropriate the requirement to undertake further environmental assessment during the on-going design

process.

This Commitments Log will be integrated into an Environmental Management Plan for the project and will evolve and be updated as each element of the project continues into the execution and subsequent operational phases. Monitoring of performance will be on-going through the life of the project.

To ensure that on-site project personnel understand the part they can play in contributing to environmental protection, TEPUK provides environmental training; such training helps to raise environmental awareness. Training is delivered through a range of techniques including E-learning, formal courses with hands-on techniques (e.g. spill response), toolbox talks and poster campaigns.

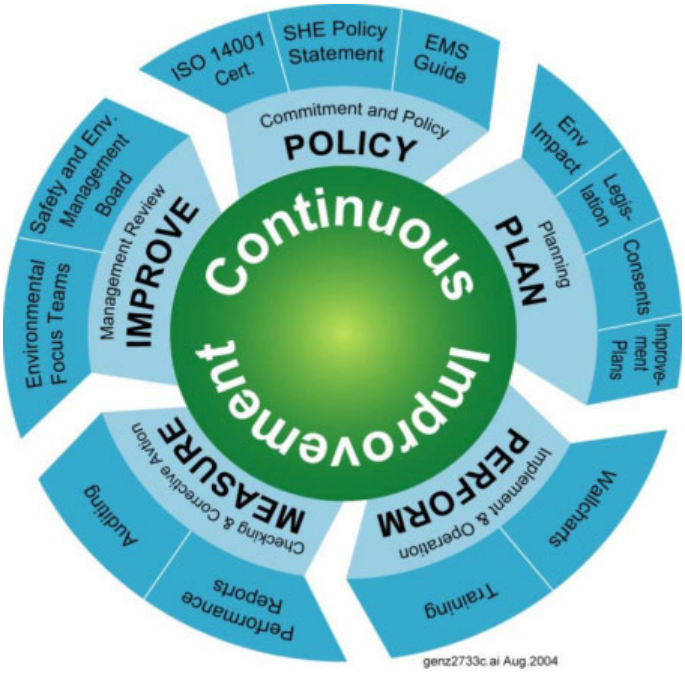

Figure S4 TOTAL E&P UK EMS framework

Commitments, objectives and targets set for the Edradour Area Development will be communicated within the invitation to tender documentation and will form part of the contractual conditions. Contractors will therefore be aware of these from the very start of operations, and contractor performance will be monitored on a monthly basis (e.g. waste generation and chemical usage). Environmental awareness presentations are also included in contractor induction sessions. A TEPUK representative will be on-board the drilling rig and key installation vessels during drilling and installation phases.

S12 CONCLUSIONS

Based on the findings of this EIA and the application of the mitigation measures identified for each potentially significant environmental impact, it is concluded that the Edradour Area Development will not result in any significant environmental impacts.

The carrying forward of the findings and recommendations of this EIA through formal commitments is intended to provide a transparent and auditable means of ensuring the measures identified will be delivered through TEPUK's Environmental Management System.