Rev UKCS Decommissioning Project

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CONTENT

Standard Information Sheet

Project (Installation) Name:	Rev UKCS Decommissioning Project
Type of Project:	Decommissioning
Undertaker name:	Repsol Norge AS
Undertaker Address:	Verven 4 Postboks 649 – Sentrum 4003 Stavanger
Licences / Owners:	Repsol Norge AS – 70% Petoro AS – 30%
Short Description:	Repsol Norge AS (Repsol) is seeking approval for decommissioning of the UK Continental Shelf (UKCS) components of the Norwegian Rev field. The Rev field, located in Production Licence 038C, Block 15/12 on the Norwegian Continental Shelf, comprises four seabed installations split into two separate areas, Rev West and Rev East. Whilst the Rev field is in the Norwegian sector of the North Sea, the export pipeline and umbilical cross over into the UKCS and connect to the Chrysaor-operated Armada installation (Block 22/05, central North Sea). The UKCS components, which are the subject of this decommissioning EIA, comprise: • Approximately 4.8 km of 12 inch gas condensate pipeline from the UK median line to the flange at the Rev Subsea Isolation Valve (SSIV) close to the Chrysaor-operated Armada platform (but excluding the SSIV itself); and • Approximately 4.9 km of the Rev electrical and hydraulic control cable (umbilical) from the UK median line to the point at which it joins the junction box close to Armada (but excluding the junction box itself).
Anticipated Commencement:	Q3 2021
Previously Submitted Environmental Documents:	Not applicable
Significant Environmental Impacts Identified:	None identified
Statement Prepared By:	Repsol Norge AS in conjunction with Xodus Group Limited

Abbreviations

AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
API	American Petroleum Institute
BEIS	Department for Business, Energy and Industrial Strategy
BG	British Gas
CA	Comparative Assessment
CATS	Central Area Transmission System
CH_4	Methane
CNS	Central North Sea
CO_2	Carbon dioxide
CoP	Cessation of Production
DECC	Department for Energy and Climate Change
DSV	Dive support vessel
EEA	European Economic Area
EHC	Electro Hydraulic Chemical
EPS	European Protected Species
ES	Environmental Statement
EU ETS	European Union Emissions Trading Scheme
EU	European Union
FOCI	Features of Conservation importance
FPSO	Floating Production Storage and Offloading
FRS	Fisheries Research Services
GHG	Anthropogenic Greenhouse Gas
HRA	Habitats Regulations Appraisal
HSE	Health and Safety Executive
ICES	International Council for the Exploration of the Sea
IEEM	Institute of Ecology and Environmental Management
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LSA	Low Specific Activity
LSC	Limits of Significant Contamination
LSE	Likely Significant Effect
MarLIN	Marine Life Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency

MCZs	Marine Conservation Zones
MMO	Marine Management Organisation
N_2O	Nitrous Oxides
NCMPAs	Nature Conservation Marine Protected Areas
NCS	Norwegian Continental Shelf
NESS	North European Storm Study
NMFS	National Marine Fisheries Services
NMPI	National Marine Plan Interactive
NNS	Northern North Sea
NO_2	Nitrogen Dioxide
NORM	Naturally Occurring Radioactive Material
NOX	Nitrogen Oxides
O_3	Ozone
OCNS	Offshore Chemical Notification Scheme
ODU	Offshore Decommissioning Unit
OCV	Offshore Construction Vessel
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
P&A	Plugging and Abandonment
PEM	Pipeline End Manifold
PLET	Pipeline End Termination
PLONOR	Poses Little Or No Risk
PMF	Priority Marine Features
PS	PLEM protection structure
pSAC	Possible Special Area of Conservation
PTS	Permanent Threshold Shift
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SAHFOS	Sir Alister Hardy Foundation for Ocean Science
SCANS	Small Cetacean Abundance in the North Sea
SCANS-II	Small Cetaceans in the European Atlantic and North Sea
SCOS	Special Committee on Seals
SEAs	Strategic Environmental Assessments
SFF	Scottish Fishermen’s Federation
SIMOPs	Simultaneous operations
SMYS	Specified Minimum Yield Strength
SNH	Scottish Natural Heritage
SO_2	Sulphur Dioxide
SOPEPs	Oil Pollution Emergency Plans

SOX	Sulphur Oxides
SPA	Special Protection Area
SSIV	Rev Subsea Isolation Valve
THC	Total hydrocarbon concentrations
TTS	Temporary Threshold Shift
UKCS	United Kingdom Continental Shelf
VGE	Varg Gas Export
VOCs	Volatile Organic Compounds
WEEE	Waste Electrical and Electronic Equipment
WFD	Waste Framework Directive
WHPS	Wellhead protection structure

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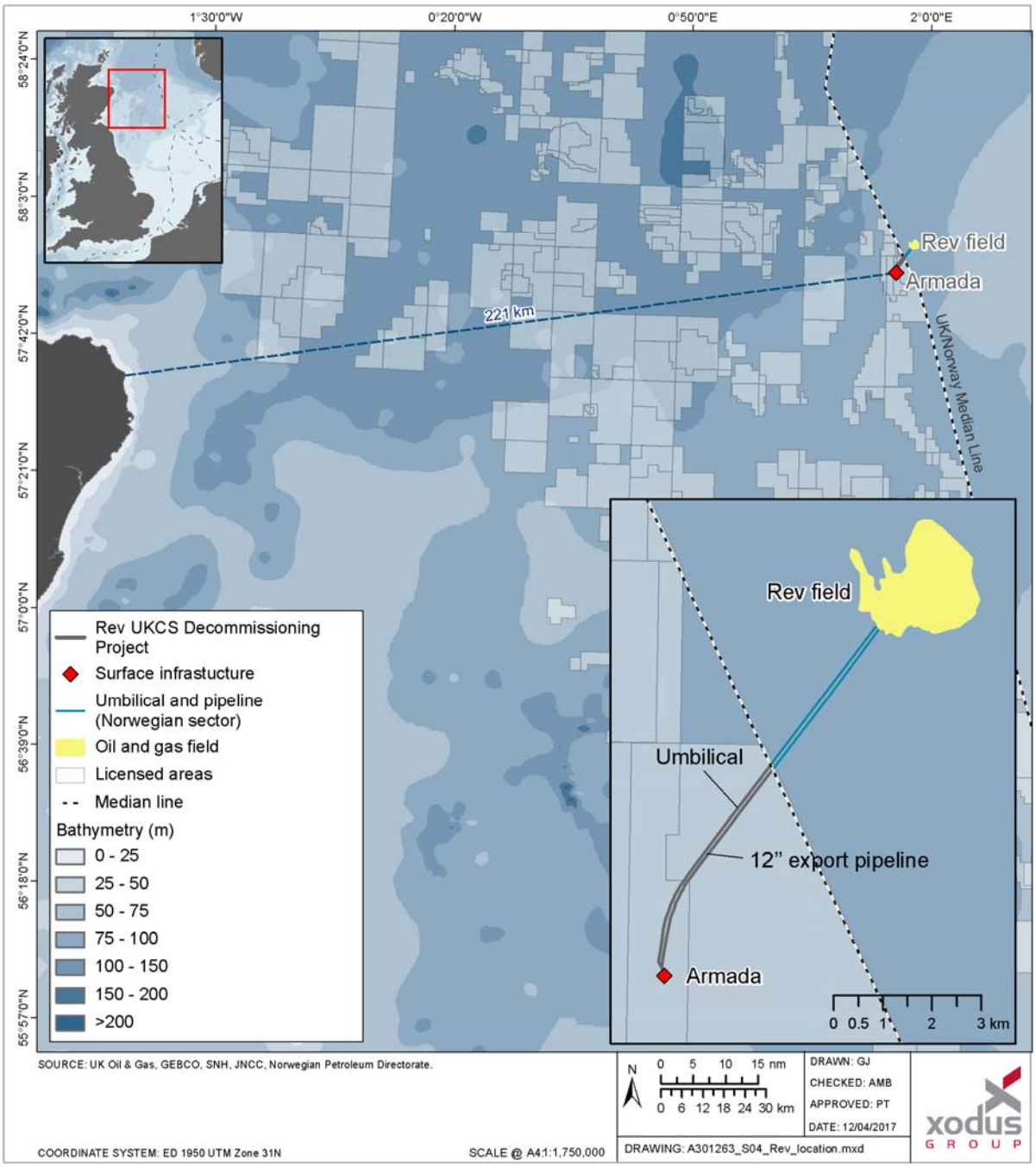
Non-Technical Summary

Introduction

The Rev field is located in, Block 15/12 on the Norwegian Continental Shelf (NCS), in the central North Sea (CNS) approximately 221 km from the Aberdeenshire coast in Scotland and 225 km southwest of Stavanger in Norway. The field is located approximately 3 km from the UK Norway median line in water depths of 90 – 110 m (Figure 1). This Non-Technical Summary provides an overview of the Environmental Statement that has been prepared specifically for the proposed decommissioning of the UKCS infrastructure of the Rev field (The Rev UKCS Decommissioning Project).

Figure 1 Location of the Rev field and Rev UKCS Decommissioning Project



The field was discovered in 2001 and the Plan for Development and Operations was approved in June 2007 with production starting in January 2009. The Rev field comprises two separate areas, Rev West and Rev East. Whilst the Rev field (West and East) is in the Norwegian sector of the North Sea, the export pipeline and umbilical cross over into the UKCS and connect to the Chrysaor operated Armada installation (Block 22/05).

In 2012 reservoir pressure at the Rev field began to decrease and has become so low that the field now only produces intermittently (at times of appropriate reservoir pressure). Based on the periodic nature of production of the Rev field, the rights holders (Repsol and Petoro AS) are planning to cease operation of the field. Rev Cessation of Production (CoP) is anticipated to take place by 31st March 2020. Once CoP has taken place the field infrastructure will be fully decommissioned.

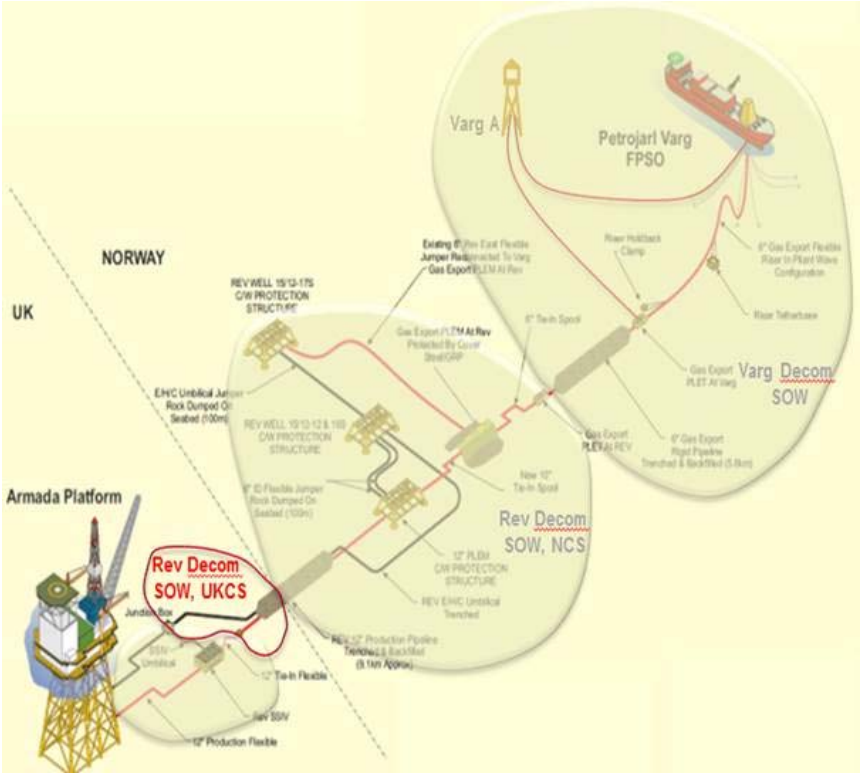
As part of the Rev infrastructure extends into the UKCS the additional documentation requirements of the UK Department for Business, Energy and Industrial Strategy (BEIS) also need to be addressed as part of the Project.

Repsol recognises that early and ongoing engagement with stakeholders is a critical part of the development of robust, respectful programmes for the decommissioning of North Sea installations and infrastructure. To ensure the efficacy of stakeholder engagement, Repsol has developed a Stakeholder Engagement Strategy and Action Plan. This Plan outlines how and why stakeholder engagement should occur. It has assisted in driving engagement through both the CA and EIA, and has been supported by a continually updated Stakeholder Engagement Workbook and Stakeholder Alignment Plan/Matrix, through which stakeholder engagement is tracked.

Scope of the Rev UKCS Decommissioning Project

The Rev infrastructure (Norway and UK) is made up of an export pipeline and an umbilical to Armada, two wellhead templates, two pipeline end manifold (PLEM) structures and various interconnecting flexibles (Figure 2).

Figure 2 Layout of the Rev field in the context of the wider area



The UKCS components (the Rev UKCS Decommissioning Project), which are the subject of this EIA, comprise:

- Approximately 4.8 km of 12" gas condensate pipeline from the UK median line to the flange at the Rev Subsea Isolation Valve (SSIV) close to the BG-operated Armada platform (but excluding the SSIV itself); and
- Approximately 4.9 km of the Rev electrical and hydraulic control cable (umbilical) from the UK median line to the point at which it joins the junction box close to Armada (but excluding the junction box itself).

The scope of work for the UK sector includes:

- Pipeline
  - Remove all concrete mattresses from the SSIV to where the pipeline is trenched and back filled. There are approximately 28 concrete mattresses to be recovered.
  - Cut the 12" pipeline where the pipeline enters the trench and rebury the pipeline end.
  - Split the flange between the 12" flexible jumper and the 12" pipeline and recover the 12" pipeline section (including the pipeline end flange) to the cut.
- Umbilical
  - Remove all mattresses from the junction box to where the umbilical is trenched and back filled. There are approximately 42 mattresses to be recovered.
  - Disconnect the umbilical from the junction box.
  - The umbilical will be cut (in Norway waters) and removed using reverse reel onto a vessel.

Figure 3 shows the infrastructure to be removed as part of the Rev UKCS Decommissioning Project.

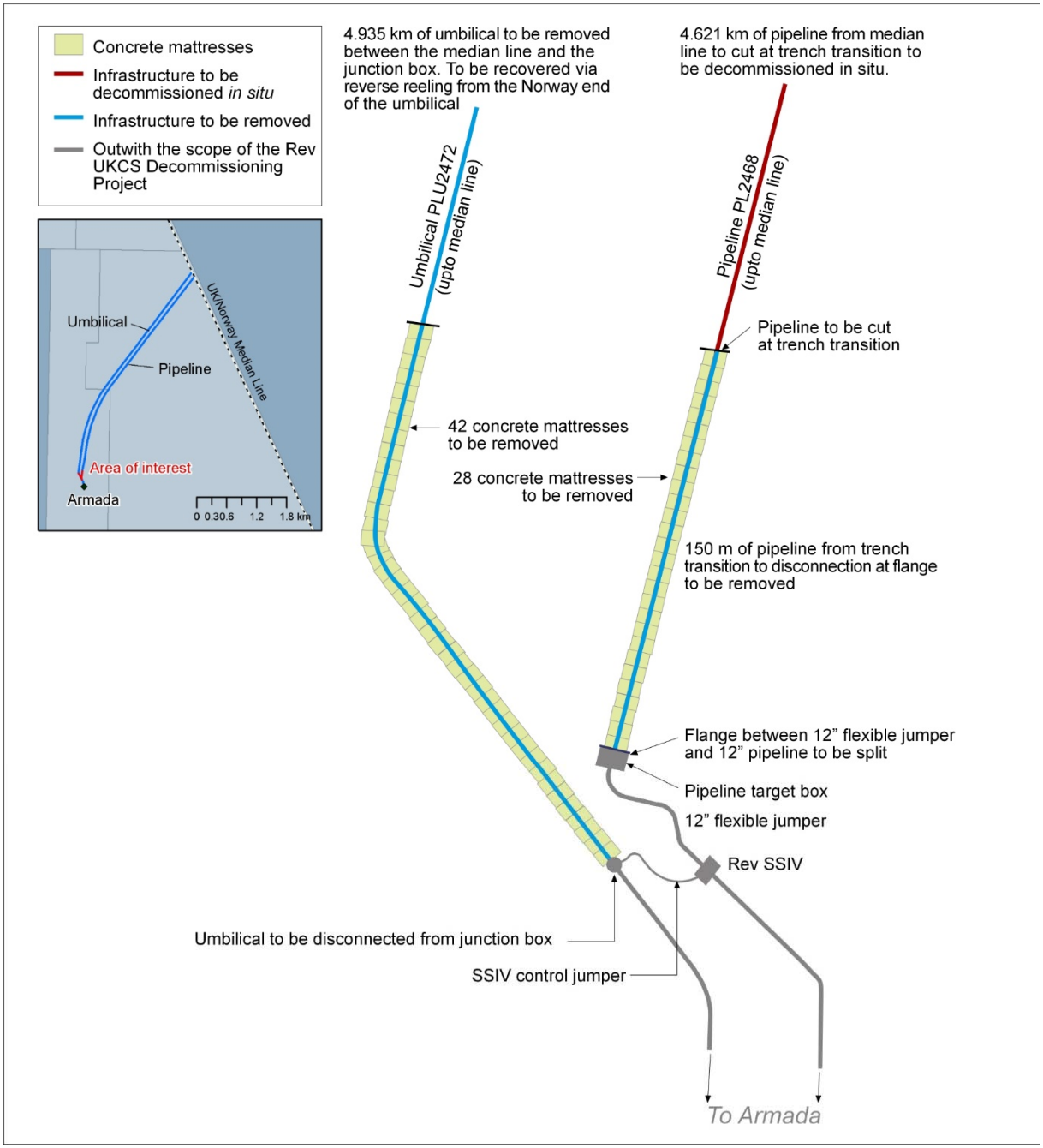
Preparation for decommissioning

The infrastructure system will be cleaned in accordance with established procedures for final disposal. Whilst the flushing and cleaning of the flowlines and umbilicals are out of scope of the EIA, potential impacts associated with the decommissioning of the lines is within the scope (e.g. discharge during removal and long-term release from any lines decommissioned *in situ*).

Cleaning of the export pipeline and umbilical involves propelling a volume of gel plug through the pipe followed by flushing with seawater equal to three times the volume to remove any debris or build up from inside the pipe. Flushing and cleaning aims to reduce the oil and chemical content of the fluids in the export pipeline and umbilical to a target cleanliness at which no environmental harm will result when containment is broken prior to decommissioning. Flushing and cleaning will also ensure minimal residue remaining on walls of the export pipeline which could be released as the pipeline wall deteriorates *in situ*. Following flushing and cleaning the pipeline and umbilical will be left unsealed and will therefore fill with seawater.

If the desired degree of cleanliness is not achieved, other methods will be considered. Disposal of oily waste from cleaning will be at the Armada platform in the UKCS or via injection into a Rev well in the Norwegian sector. Alternatively, oily waste could be taken onshore for disposal.

Figure 3 Infrastructure to be decommissioned as part of the Rev UKCS Decommissioning Project



Options for decommissioning

Comparative Assessment (CA) is a process by which decisions can be made on the most appropriate approach to decommissioning. As such, it is a core part of the overall decommissioning planning process being undertaken by Repsol for the Rev UKCS Decommissioning Project. As required under the Petroleum Act 1998, all feasible decommissioning options are being considered in order to arrive at the best decommissioning option for the pipeline and umbilical. The CA will examine and compare each option.

For each of the decommissioning options data or assessment will be presented on:

- Technical feasibility and risk;
- Safety;
- Environmental impact;
- Societal impact; and
- Economics.

Options considered as part of the CA process are detailed in Table 1.

Table 1 Decommissioning options considered as part of CA

Infrastructure	Option 1	Option 2	Option 3
Export pipeline	Full removal of pipeline. The pipeline will be cut into a number of suitably sized segments and lifted from the seabed to the vessel. No infrastructure would remain.	Decommission *in situ*. Dredging to approximately 1 m below the seabed to cut and remove ends which will be brought to shore. Potential for rock dump on areas of burial of less than 0.6 m and exposed ends.	N/a
Umbilical	Full removal using reverse reeling onto vessel. Ends of umbilical will be cut and reverse reeling will occur from the Rev end of the umbilical. No infrastructure would remain.	Decommission *in situ*. Ends of umbilical will be cut and removed and rock dump will be carried out to cover exposed ends.	Decommission *in situ*. Ends of umbilical will be cut and removed and rock dump will be carried out to cover exposed ends and additional rock dump will be used to increase the burial depth.
Shaded cells represent the chosen options for decommissioning of infrastructure.			

The conclusion of the CA for the decommissioning of the export pipeline was Option 2 (decommissioning *in situ* with removal of ends) ranked the most highly. For the decommissioning of the umbilical, Options 1 and 2 ranked very closely with a difference of only 0.19% in terms of preference (taking into account societal, technical, environmental, economic and safety factors). The option which ranked the highest was Option 2 (decommissioning *in situ* with removal of cut ends). This option would mean the umbilical remains buried in the trench and would require future monitoring in order to assure the umbilical remained at an acceptable burial depth of 0.6 m. In order to preserve this depth it is possible that future remedial work would be needed in the form of seabed maintenance or rock dump. Given the BEIS guidelines preference is full removal of infrastructure and the likelihood of future seabed disturbance as a result of Option 2, Option 1 (full removal by reverse reeling) was selected as the preferred option for the umbilical.

Decommissioning programme

Repsol anticipates executing the Rev UKCS Decommissioning Project from 2021 - 2022. The specific timing of decommissioning activities will be agreed with BEIS and with the Health and Safety Executive (HSE) and applications for all relevant permits and consents will be submitted and approval sought prior to activities taking place.

Repsol will select one or more subsea contractors to mobilise a fleet of vessels with a range of capabilities:

- Cranes for lifting objects of different sizes and weights off the seabed;
- Capability to support underwater operations (including Remotely Operated Vehicle (ROV) deployment, diving, cutting, excavation and rock placement); and
- Survey vessels.

The vessels will also deploy ROVs to disconnect the subsea infrastructure as required. Cranes on board the vessels will lift removed infrastructure onboard as required. Vessels to be used during the Rev UKCS Decommissioning Project are detailed in Table 2.

Table 2 Vessels to be used during the Rev UKCS Decommissioning Project

Vessel type	Decommissioning activity	Approximate number of days		
		Mobilisation/de mobilisation	In transit	In the field
Offshore Construction Vessel (OCV)	Decommissioning 12" export pipeline	1	2	2
	Decommissioning of umbilical	1	2	5
Trawler	Over trawling surveys post decommissioning	1	2	1
Survey vessel	Monitoring surveys post decommissioning*	3	6	3
Total		**29 vessel days**		

* Assuming one survey immediately after decommissioning and two further at three year intervals.

Note, vessels associated with flushing and cleaning are not include here.

Decommissioning of the export pipeline and decommissioning of the umbilical have been considered independently in terms of vessel requirements. It has been considered that the two events will occur at different times. If there is the need for any rock dump in the decommissioning of the export pipeline this will occur from the OCV as the volume will be minimal and there will be no requirement for a separate rock dump vessel. The use of an ROV has not been considered in terms of vessel use as it is assumed that this will be transported on the OCV. An overtrawling survey and a monitoring survey will occur immediately following decommissioning activities. Following this two further monitoring surveys will occur at three year intervals to monitor the seabed. It is anticipated the environmental impact will be minimal enough to negate the requirement for further surveys however this cannot be confirmed until the results of the proposed surveys are assessed. The exact survey scope will be determined in consultation with ODU and their consultees. The infrastructure lifted from the seabed will be transported to an onshore dismantling site by the vessels described above.

As part of the Rev UKCS Decommissioning Project some infrastructure will be decommissioned *in situ* (remain in place following decommissioning) and some will be brought ashore for the relevant disposal. Table 3 details the methods to be employed for decommissioning the various infrastructure and the quantities which will remain in place and be brought ashore.

Table 3 Decommissioning methodology and associated quantities

Infrastructure	Decommissioning method	Quantity/details	
		To be left *in situ*	To be brought ashore for disposal
12" export pipeline	The 12" export pipeline is currently trenched and rock-dumped for the majority of its length. The pipeline will be cut at the trench transition end of mattresses and just behind the end fitting of the flexible jumper using hydraulic shears. A cofferdam and ROV will be utilised in cutting the pipeline. The export pipeline line will be cut into manageable lengths of approximately 15-20 m), the cut sections shall be recovered using a hydraulic lifting beam to lift onto the deck of the OCV. The exposed pipeline end will be reburied by ROV utilising the material that was originally burying the pipeline.	4.621 km (896,474 kg)	0.15 km (29,100 kg)
Umbilical	The trenched and buried umbilical is to be completely removed. The umbilical will be disconnected from the junction box at the Armada end and will be cut at the Rev end in Norwegian waters. A recovery head will be attached to the umbilical (this tool allows a firm hold to be made on the pipeline) at the Rev end and then the reverse reeling will be initiated.	Nothing to be left *in situ*	4.935 km (187,530 kg)
Concrete mattresses	Concrete mattresses are in place on unburied sections of the export pipeline and umbilical. It is anticipated that 28 concrete mattresses will be removed from the export pipeline and 42 from the umbilical. These will be brought ashore and disposed of accordingly.	Nothing to be left *in situ*	70 in total (28 to be removed from export pipeline and 42 from umbilical). Each mattress is 6 m x 3 m x 0.15 m and weighs 4,700 kg. Total weight of mattresses brought back to shore is 329,000 kg

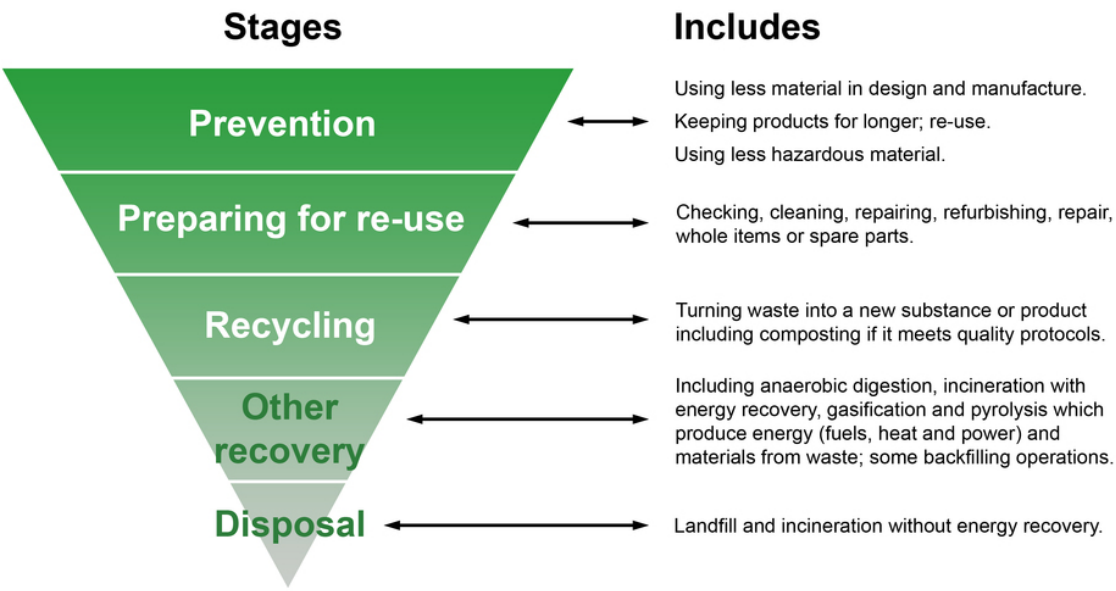
Environmental management

Beyond the main period of preparation for decommissioning and the actual decommissioning activities, the Rev UKCS Decommissioning Project has limited activity associated with it (there are likely to be a small number of post-decommissioning surveys, the scope of which will be decided with ODU and their consultees). The focus of environmental performance management for the Project is therefore to ensure that the activities that will take place during the limited period of decommissioning happen in a manner acceptable to Repsol (and to stakeholders). The primary mechanism by which this will occur is through Repsol's Environmental Management Policy and specifically through the EMS that it requires be operational.

The location of decommissioned infrastructure to be removed from the Project site has not been finalised. The location will either be in the UK or Norway. Legislation and waste management requirements of the destination country will be adhered to and Repsol's own waste management strategy applied in either case.

A Waste Management Plan will be developed for the Rev Decommissioning Project to further identify the types of waste generated and the management procedures for each waste stream. Repsol will ensure the principles of the Waste Management Hierarchy (Figure 4) as described in Article 4 of the revised EU Waste Framework Directive are followed during the decommissioning activities.

Figure 4 Waste management hierarchy



Environment description

Based on previous experience, studies (including project-specific surveys), review of scientific data and consultation, it has been possible to identify the key environmental sensitivities in the Rev UKCS Decommissioning Project area; these are summarised in Table 4.

Table 4 Environmental sensitivities in the vicinity of the Rev UKCS Decommissioning Project

Seabed and associated animals
Surveys in the area describe the seabed as flat and relatively smooth with occasional undulations. seabed sediments comprise fine to medium silty sand, with the sand being present as a veneer over firm gravelly, sandy clay. None of the surveys in the Project area recorded the presence of any Annex I habitats. Surveys which have been carried out inthe vicinity of the Project area report that the species present are relatively uniform and annelid worms are prominent. No species of conservation interest were recorded.
Fish
The fish populations in the Project area are characterised by species typical of the central North Sea, including long rough dab, hagfish and Norway pout. Basking shark, tope and porbeagle are all also likely to occur in small numbers. The Project area is located within the spawning grounds of cod, Norway pout and sand eel; meaning that these species use the area for breeding. Nursery grounds, (where juvenile fish remain to feed and grow) also occur for a number of commercial species in the Project area.

Seabirds
The Project area is important for fulmar, northern gannet, great black-backed gull, Atlantic puffin, black-legged kittiwake and common guillemot for the majority of the year. Manx shearwaters are present in the vicinity of the Project area between the spring and autumn months. European storm petrels are present during September and November. Great skua, glaucous gull, Arctic skua and little auk may be present in low densities for the majority of the year.
Whales, dolphins and Seals
 Spatially and temporally, harbour porpoises, white-beaked dolphins, minke whales, killer whales and white-sided dolphins are the most regularly sighted cetacean species in the North Sea and may be encountered in the vicinity of the Project area. Given the distance to shore, species such as the bottlenose dolphin and grey and harbour seals are unlikely to be sighted in the Project area.
Conservation
None of the survey work undertaken in the Project area has identified any seabed habitats or species that are of specific conservation significance. The Norwegian Sediment Boundary Plain Nature Conservation Marine Protected Area (NCMPA) is located approximately 4.5 km from the offhsore Project area the site has been designated for aggregations of ocean quahog and the sand and gravel habitat that supports the species. The closest Special Area of Conservation (SAC) to the Project area is the Scanner Pockmarks SAC located approximately 61 km to the northeast.
Fisheries and other sea users
The Project area is located in in ICES rectangle 44F1 which is targeted for demersal, pelagic and to a lesser extent shellfish species. Haddock and Nephrops were the most valuable species landed from 2011 to 2015. Trawls are the most utilised gear type and effort is greatest in the latter half of the year with September and November being the months of greatest effort from 2011 to 2015. There is very little shipping activity in the Project area, and no site of renewable or archaeological interest. There is also limited infrastructure related to other oil and gas developments.

Impact Assessment

The Rev UKCS Decommissioning Project Environmental Impact Assessment has been informed by a number of different processes including; scoping with the Regulators and their statutory advisors, workshops with specialists and the Comparative Assessment process. Where potentially significant impacts have been identified, mitigation measures have been considered. The intention is that such measures should remove, reduce or manage the potential impacts to a point where the impacts are not significant. Table 6 presents the findings of the Environmental Impact Assessment for the potentially significant impacts identified for the Project. The potential for cumulative and transboundary impacts is also considered.

Key potential impacts assessed	Significance
Energy use and atmospheric emissions	
Impact assessment: Using energy to power vessels results in emissions to the air, which can contribute to local air quality issues; the absence of vulnerable receptors in the offshore area means this is not an issue for the Project. However, emissions to air can act cumulatively with those from other activities (such as onshore power generation and use of cars) to contribute to global climate change. These emissions from the Project may come from vessel use but also through linked activities such as the recycling of materials brought onshore. **Cumulative**: Since emissions to air offshore is largely a cumulative issue, it is important to consider how the decommissioning activities sit in the context of other UK emissions. The latest available total annual CO_2 emissions estimate	Not significant

Key potential impacts assessed	Significance
from oil and gas exploration and shipping total 24,232,726 tonnes of CO_2. The total CO_2 emissions from the decommissioning activities are estimated to be approximately 2,421.38 tonnes, which will contribute approximately 0.00002% of the atmospheric emissions associated with UK offshore shipping and oil and gas activities. It is worth noting that the Rev UKCS Decommissioning Project will contribute to the removal of emissions produced as a result of the operational Rev field. **Transboundary**: There is not predicted to be a transboundary impact from the emissions, since the contribution of the emission to global climate change is negligible.	
Discharges to sea	
Impact assessment: Flushing and cleaning of lines will occur prior to decommissioning. There will be no risk of release of hydrocarbon or chemicals on cutting the export pipeline and umbilical. The negligible amount of residual hydrocarbon remaining in the export pipeline may be released over time as the pipeline degrades *in situ*, however the volume will be minute and dispersed rapidly. **Cumulative**: No cumulative impacts are predicted. The negligible amount of hydrocarbon that may be released over a period time will not contribute to any other discharges in the vicinity of the Rev UKCS Decommissioning Project in a significant manner. **Transboundary**: Despite the proximity to the UK/Norway median line, the extremely small potential discharge volume means there is not expected to an impact outside of UK waters. **Effects on protected sites**: The extremely small discharge volume and the means there is not expected to be any impacts to protected sites.	Not significant
Other sea users	
Impact assessment: The limited number of vessel days required to execute the decommissioning project means there is no real prospect of significantly affecting fisheries users through temporary exclusion (i.e. where Project vessels stop them using the sea area). Additionally, the infrastructure will either be removed or buried sufficiently to mean that it will pose no risk to fisheries through snagging, which means there will also be no longer term exclusion. **Cumulative**: Since there will be no real short or long term exclusion resulting from, there is not expected to be a negative cumulative impact with other decommissioning activities in the vicinity. **Transboundary**: There are a number of non-UK vessels using the Project area. However, given the relatively low effort recorded in the area and the overtrawlable nature of the infrastructure that is decommissioned *in situ*, there is not thought to be a mechanism by which significant transboundary impacts could occur.	Not significant
Underwater noise	
Impact assessment: Noise emitted from vessel use and cutting of infrastructure could impact upon marine mammal and fish use of the Project area. However, the noise emissions are predicted to be sufficiently quiet that there is no prospect of injuring the animals or damaging their hearing. Since the cutting activities will occur for a short period of time and only one vessel will be used for short periods of time intermittently, there is no real prospect of disturbing animals sufficiently to disrupt feeding or breeding activities. **Cumulative**: In the context of the possible cumulative impact from noise emissions as part of the decommissioning activities, the fact that the Project area is not of key importance to marine mammals or fish and that noise-emitting	Not significant

Key potential impacts assessed	Significance
activities will be limited , there is not considered to be a likelihood of the subsea decommissioning activities causing impact through cumulative means. **Transboundary**: Despite the proximity to the UK/Norway median line, the highly localised nature of the noise emissions means there is not expected to be a direct impact to species outside of UK waters. It is likely, however, that animals experiencing noise emissions in UK waters will move to non-UK waters; since there is no likely injury or disturbance to animals in the Project area, animals moving outside of UK waters as part of normal behaviour does not constitute a significant impact. **Effects on protected sites**: Although it is possible that marine mammals from protected sites nearshore or in the Southern North Sea could experience noise emissions from the Project as they move through the Project area, there is not expected to be a mechanism for impacting those species and thus no impact on the protected sites to which they belong.	
Seabed	
Impact assessment: Interaction with the seabed will occur during decommissioning activities. In the main, this will come from the overtrawls that will be conducted to ensure the seabed is left in a suitable condition for future use by fisheries. This could result in direct disturbance to an area of approximately 1,408,821.15 m^2 and indirect disturbance (sediment released into the water column) to an area of approximately 1,514,786.96 m^2. **Cumulative**: In the context of the possible cumulative impact from seabed disturbance occurring as part of other decommissioning activities in the vicinity, the absence of seabed habitats and species of conservation interest and the likely recovery of the seabed means that there is not considered a likelihood of the subsea decommissioning activities causing impact through cumulative means. **Transboundary**: Despite the proximity to the UK/Norway median line, the highly localised nature of the seabed interaction means there is not expected to be an impact to seabed habitat or species outside of UK waters. **Effects on protected sites**: Any potential seabed impacts associated with the Rev UKCS Decommissioning Project will not occur within any protected sites. Neither do seabed impacts spread sufficiently far to interact any protected areas.	Not significant
Accidental events	
Impact assessment: The main potential impact from an accidental event associated with the decommissioning activities is the release of fuel from a vessel involved in a collision. The conditions in the offshore environment would mean that any release would disperse relatively quickly. **Cumulative**: Any accidental hydrocarbon release in the Project area is expected to dissipate rapidly. It is considered very unlikely that additional accidental releases from other sources would occur in the same timeframe and produce a cumulative impact. **Transboundary**: The Rev UKCS Decommissioning Project reaches the UK-Norway median line. It is therefore possible that an accidental hydrocarbon release in the Project area would cross into the Norwegian sector. Any accidental spill is unlikely to have a significant impact in Norwegian waters due to the rapid dispersion of hydrocarbons. In theunlikely of event of a large diesel spill, it may be necessary to implement the NORBRIT Agreement (the Norway-UK Joint Contingency Plan). The NORBRIT Agreement sets out command and control procedures for pollution incidents likely to affect both parties, **Effects on protected sites**: Given the rapid dispersion expected it is considered unlikely that an accidental spill would impact on any protected sites	Not significant

Key potential impacts assessed	Significance
or species. The closest protected site is the Norwegian Boundary Sediment Plain NCMPA, given the water depths here range from a minimum of 80 m to a maximum of approximately 120 m, it is very unlikely that hydrocarbons would be redistributed to these depths in sufficient quantities or thickness to affect the protected seabed features. For these reasons, there is predicted to be no impact on sites designated for seabed features.	

Conclusions

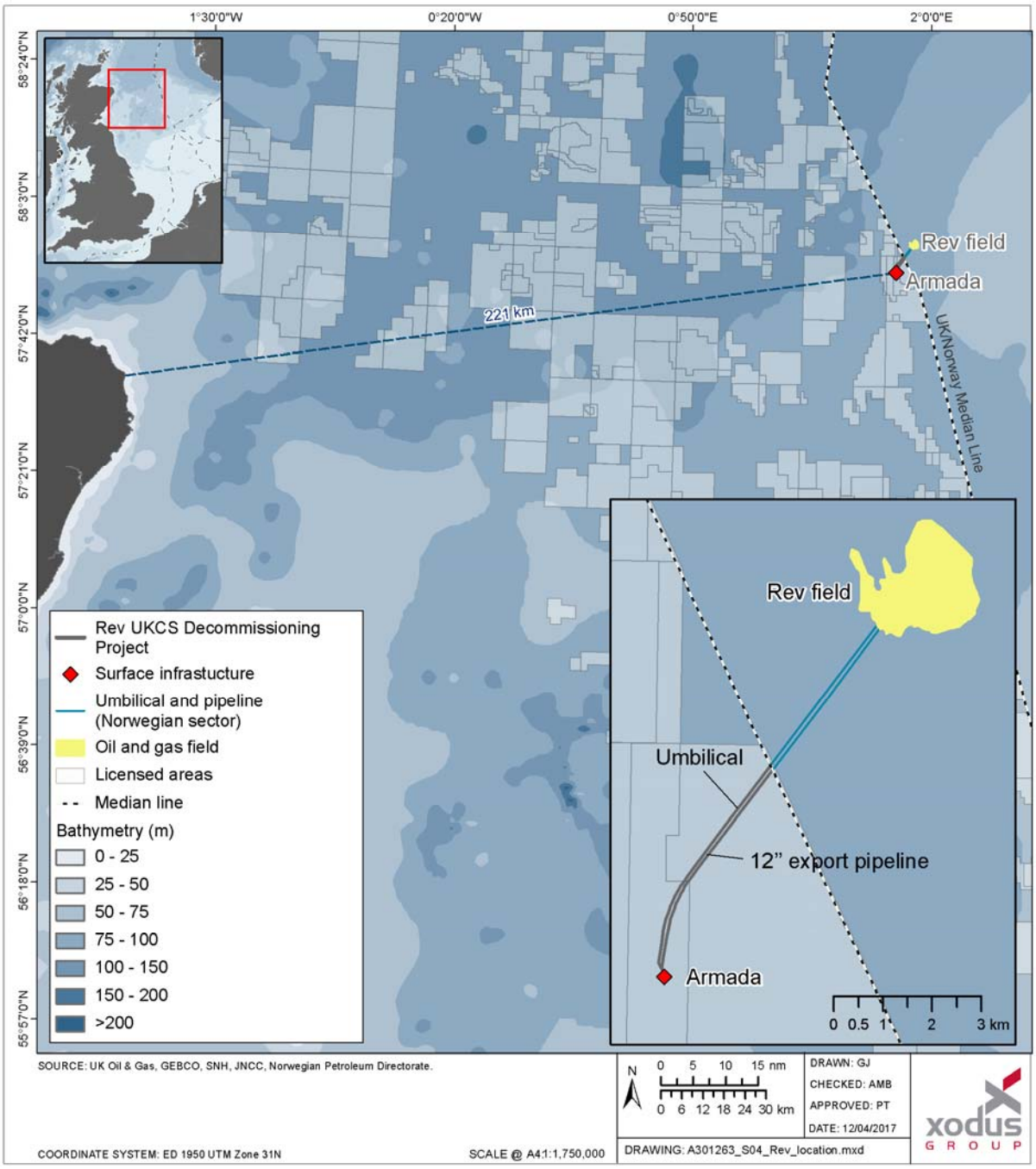
The planned operations have been rigorously assessed through the Environmental Impact Assessment and Comparative Assessment processes, resulting in a set of selected options which are thought to present the least risk of environmental impact whilst satisfying safety, environmental, technical, societal and economic requirements. Based on the findings of the Environmental Impact Assessment and the identification and subsequent application of the mitigation measures identified for each potentially significant environmental impact it is concluded that the Rev UKCS Decommissioning Project will result in no significant environmental impact.

1 Introduction

1.1 Rev Field Description

The Rev field is located in, Block 15/12 on the Norwegian Continental Shelf (NCS), in the central North Sea (CNS) approximately 221 km from the Aberdeenshire coast in Scotland and 225 km southwest of Stavanger in Norway. The field is located approximately 3 km from the UK Norway median line in water depths of 90 – 110 m (Figure 1-1).

Figure 1-1 Location of the Rev field and Rev UKCS Decommissioning Project



The field was discovered in 2001 and the Plan for Development and Operations was approved in June 2007 with production starting in January 2009. The Rev field comprises two separate areas, Rev West and Rev East. Whilst the Rev field (West and East) is in the Norwegian sector of the North Sea, the export pipeline and umbilical cross over into the UKCS and connect to the Chrysaor operated Armada installation (Block 22/05). Gas and condensate production from the Rev wells is exported to the Armada platform for processing at the Central Area Transmission System (CATS) terminal and further export to the U.K (Figure 1-2). An overview of the Rev infrastructure is shown in Figure 1-3. Repsol Norge (Repsol) is the operator for the Rev field after taking over the ownership from Talisman Norge in 2015.

Figure 1-2 Layout of the Rev field in the context of the wider area

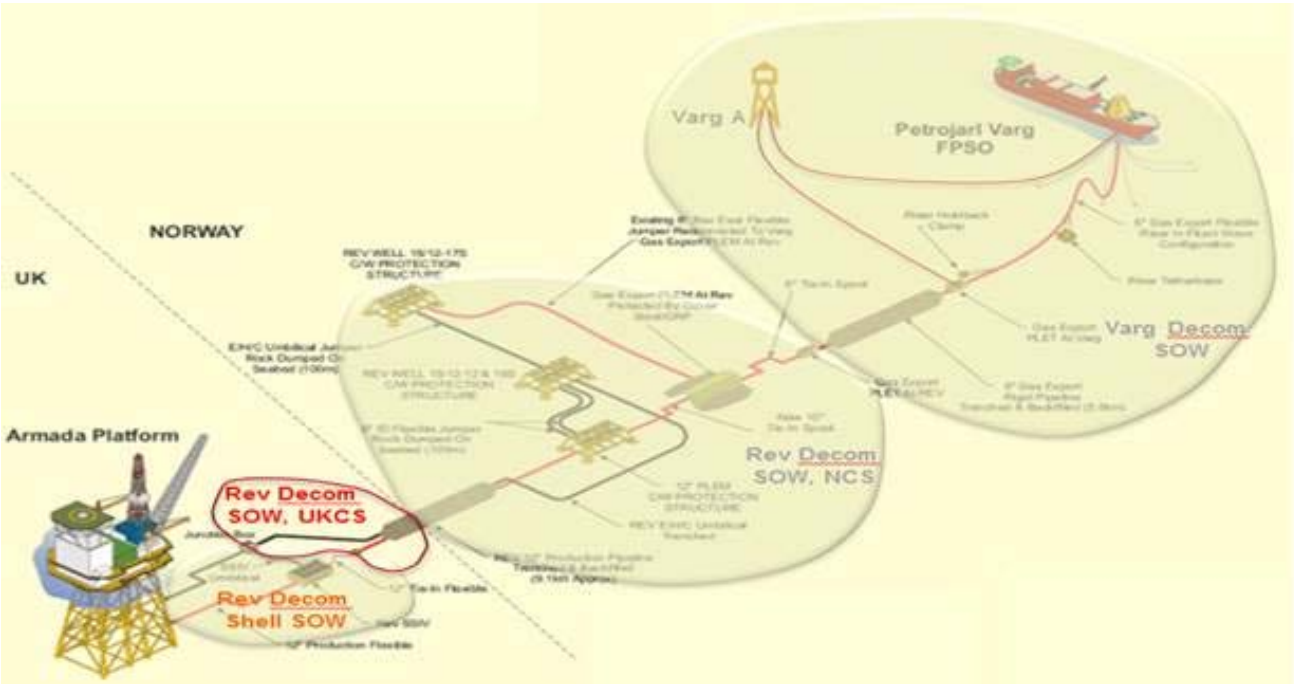
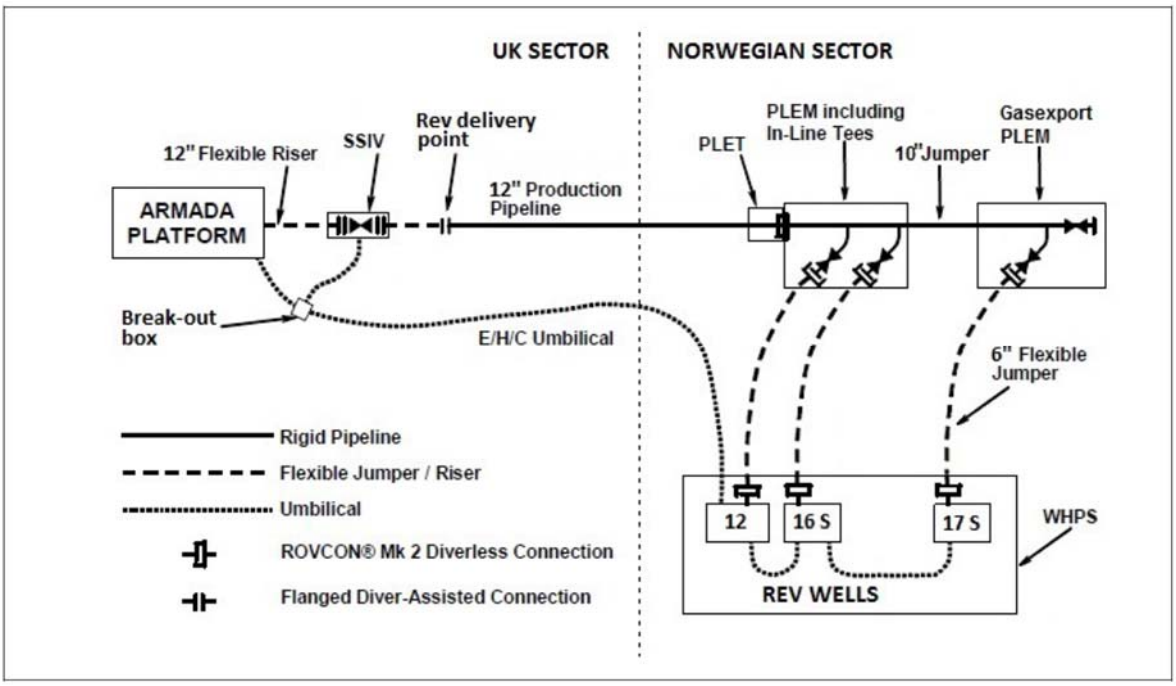


Figure 1-3 Overview of Rev Infrastructure



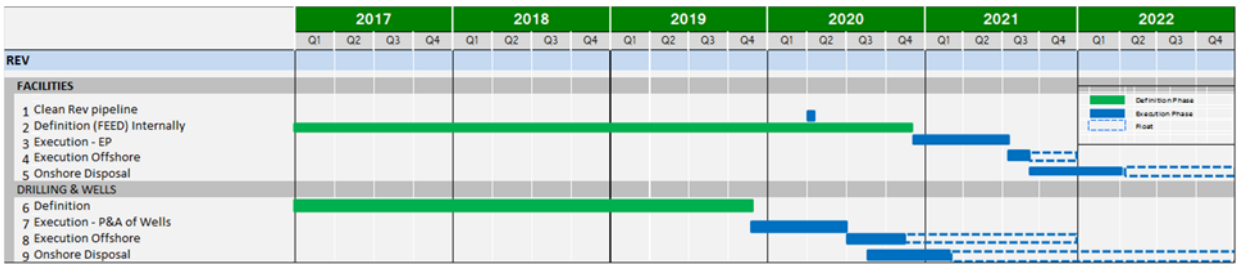
1.2 The Rev Field Decommissioning Project

In 2012 reservoir pressure at the Rev field began to decrease and has become so low that the field now only produces intermittently (at times of appropriate reservoir pressure). Based on the periodic nature of production of the Rev Field, the rights holders (Repsol Norge AS and Petoro AS) are planning to cease production of the field, the latest date is 31st March 2020, but could be earlier.

The Rev Field Decommissioning Plan was prepared based on the requirements of the Oslo Paris (OSPAR) Convention and of the Norwegian Petroleum law. This plan was issued to the Norwegian Ministry of Petroleum and Energy in August 2015 and proposes the completion of the offshore removal activities within 2022. An indicative schedule for the Rev Decommissioning Project is shown in Figure 1-4. The filled blue bars are latest dates the work is currently planned, however the work could commence earlier if opportunities arise. The dotted bars indicate potential activity schedule windows and that all activities will be completed by end of Q4 2022. The activities (2 & 6) shown in green are the relevant planning activities for facilities and drilling & wells and cover all the preparation works such as studies, tendering for the execution scope, preparation for execution documentation, preparation for application for consent for the drilling rig, preparation for permits, etc.

All the activities shown in blue are the actual execution scope covering both engineering as well as the work offshore and onshore recycling/disposal.

Figure 1-4 Indicative schedule for the Rev UKCS Decommissioning Project



Green: Definition phase Blue: Execution phase Dashed: Float

As part of the Rev infrastructure extends into the UKCS the additional documentation requirements of the UK Department for Business, Energy and Industrial Strategy (BEIS) also need to be addressed as part of the Project.

1.3 Purpose and Scope of the Environmental Impact Assessment (EIA)

1.3.1 Purpose of this Document and the EIA

This Environmental Statement (ES) reports the outcome of the EIA process undertaken in support of the proposed decommissioning activities for the Rev UKCS Decommissioning Project. The scope of the EIA was developed during scoping and wider consultation. Full details of the method applied during the EIA process are described in section 6. The overall aim of the EIA has been to assess the potential environmental impacts that may arise from the Project and to identify any measures that will be put in place to reduce the magnitude or likelihood of these potential impacts. The EIA process has run in parallel to the Comparative Assessment (CA) process and has informed decisions taken on the approach to decommissioning, and as such is considered integral to the Project. The EIA process also provides a framework for stakeholder involvement so that issues can be identified and addressed as appropriate at an early stage, as well as helping the planned activities comply with environmental legislative requirements and Repsol's own environmental policies.

1.3.2 Structure of this ES

To clearly and concisely report the findings of the EIA, this ES has been structured as follows:

- A non-technical summary of the ES;
- Description of the background to the Project; role of the EIA and legislative context (this section);
- Description of the Project and alternatives considered, including a description of the CA process (section 2);
- Description of stakeholder consultation (section 3);
- Description of the environmental management measures (section 4);
- Description of the environment and identification of the key environmental sensitivities which may be impacted by the Project (section 5);
- Description of the methods used to identify and evaluate the potential environmental impacts (section 6);
- Detailed assessment of key potential impacts, including assessment of potential cumulative and transboundary impacts (sections 7-12);
- Consideration of how waste will be managed through the Project (section 13); and

- Conclusions (section 14).

1.3.3 Geographical scope

The focus of the EIA presented in this ES is the UKCS components of the decommissioning operations related to the Rev field (the Rev UKCS Decommissioning Project). The Norwegian components of the decommissioning programme have been assessed in a separate EIA, the results of which are presented in an ES which has already been submitted to the Norwegian authorities and accompanies this ES as Appendix A. The Project area is shown in Figure 1-1.

1.3.4 EIA scope

The Rev infrastructure (Norway and UK) is made up of an export pipeline and an umbilical to Armada, two wellhead templates, two pipeline end manifold (PLEM) structures and various interconnecting flexibles (Figure 1-2).

The UKCS components (the Rev UKCS Decommissioning Project), which are the subject of this EIA, comprise:

- Approximately 4.8 km of 12" gas condensate pipeline from the UK median line to the flange at the Rev Subsea Isolation Valve (SSIV) close to the BG-operated Armada platform (but excluding the SSIV itself); and
- Approximately 4.9 km of the Rev electrical and hydraulic control cable (umbilical) from the UK median line to the point at which it joins the junction box close to Armada (but excluding the junction box itself).

The Rev UKCS Decommissioning Project Scope of Work involves:

- Subsea infrastructure removal;
- Potential for rock dump on exposed ends and areas of low burial;
- Disposal activities, and
- Monitoring activities after removal.

1.4 Permits, Consents and Other Related Documents

The BEIS Guidance Notes state that operators must apply for appropriate environmental consents and licences before undertaking the activities proposed in the Decommissioning Programme. This ES has also been prepared to support the permit and consent applications that will be made in due course for:

- Consents to use or discharge chemicals under the Offshore Chemicals Regulations 2002;
- Marine licences to place items on, or remove items from, the seabed under the Marine and Coastal Access Act 2009; and
- Licences under the Waste Management Licensing Regulations.

1.5 Regulatory context

1.5.1 Decision-making

BEIS's 'Guidance Notes Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998' (DECC, 2011) state that OSPAR Decision 98/3 does not apply to pipelines. Instead, these structures are considered on a case-by-case basis, informed by 'Comparative Assessment' of the feasible decommissioning options that take account of safety, environmental, technical, societal and economic factors. For pipelines covered with rock protection, the Guidance Notes state that these will remain in place unless there are special circumstances warranting removal. Small diameter pipelines (including flexible flowlines and umbilicals) which are neither trenched nor

buried should normally be entirely removed. Finally, mattresses and grout bags installed to protect pipelines should be removed for disposal onshore if their condition allows.

The guidance also highlights instances where pipelines could be decommissioned *in situ*. For example, pipelines that are adequately buried or trenched or which are expected to self-bury could be considered as candidates for *in situ* decommissioning.

1.5.2 Regulatory submission

The Petroleum Act 1998 (as amended by the Energy Act 2008) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the UKCS. The Act requires the operator of an offshore installation or pipeline to submit a Decommissioning Programme for statutory and public consultation, and to obtain approval of the Decommissioning Programme from BEIS before initiating decommissioning work. The Guidance Notes state that a Decommissioning Programme needs to be supported by an EIA that includes an assessment of:

- Potential impacts on the marine environment, onshore environment, and atmosphere;
- Consumption of natural resources and energy associated with reuse and recycling;
- Interference with other legitimate uses of the sea; and
- Potential socio-economic impacts.

This ES details the EIA that has been conducted for the Rev UKCS Decommissioning Project and is submitted in support of the Decommissioning Programme. Following submission of the Decommissioning Programme and supporting documents to BEIS, stakeholders, including the public, are invited to comment on the proposals.

1.5.3 Protected sites

Under Article 6.3 of the Habitats Directive, applied to UK offshore waters by the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001, it is the responsibility of the Competent Authority[1] to make an appropriate assessment of the implications of a plan, programme or project, alone or in combination, on a European protected site (a Special Area of Conservation (SAC) or Special Protection Area (SPA)), in view of the site's conservation objectives and the overall integrity of the site. An appropriate assessment considers whether or not a 'likely significant effect' (LSE) will occur. As part of the assessment of impacts on key receptors presented in this ES, for those receptors that are a qualifying feature of a European protected site, relevant information on these sites has been provided. This information can be used by the Competent Authority to determine the need for, and subsequently carry out (if required), an appropriate assessment of a project.

As part of an analogous process for Nature Conservation Marine Protected Areas (NCMPAs) and Marine Conservation Zones (MCZs) designated under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009, the Competent Authority must consider whether the proposed activities are capable of affecting (other than insignificantly) a protected feature, or if there is a significant risk of them hindering the achievement of the stated conservation objectives. If there is a significant risk, the Competent Authority may only permit the activity if there is no alternative manner of proceeding that has significantly lower risk of hindering the conservation objectives, the benefit to the public outweighs the risk to the environment and that beneficial environmental offsets will be implemented.

1.5.4 Scottish National Marine Plan

The Scottish Government adopted the National Marine Plan in early 2015 (Scottish Government, 2015) to provide an overarching framework for marine activity in Scottish waters, in an aim to enable sustainable development and the use of the marine area in a way that protects and enhances the marine environment whilst promoting both existing and emerging industries. This is underpinned by a core set

1 Competent Authority is the authority responsible for determining all permit/licence applications. For oil and gas projects located in UK waters the Competent Authority is BEIS.

of general policies which apply across existing and future development and use of the marine environment; policies of particular relevance to the Rev UKCS Decommissioning Project include:

- Comply with legal requirements for protected areas and protected species;
- Not result in significant impact on the national status of Priority Marine Features (PMF); and
- Protect and, where appropriate, enhance the health of the marine area.

Sectoral policies are also outlined in the Plan where a particular industry brings with it issues beyond those set out in the general policies. Specifically for the Rev UKCS Decommissioning Project, oil and gas objectives and policies are of relevance; these are detailed in section 4, along with comment on the degree to which the Project is aligned with such objectives and policies.

1.6 Environmental Management

Relevant to the EIA, and to all of Repsol's activities, is the company's commitment to managing all environmental impacts associated with its activities. Continuous improvement in environmental performance is sought through effective project planning and implementation, emissions reduction, waste minimisation, waste management, and energy conservation; this mind-set has fed into the development of the mitigation measures developed for the Project. Further details on the specific implementation of environmental management measures for the Project are presented in section 4.

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2 Stakeholder Consultation

2.1 Engagement Strategy

Repsol recognises that early and ongoing engagement with stakeholders is a critical part of the development of robust, respectful programmes for the decommissioning of North Sea installations and infrastructure. To ensure the efficacy of stakeholder engagement, Repsol has developed a Stakeholder Engagement Strategy and Action Plan. This Plan outlines how and why stakeholder engagement should occur. It has assisted in driving engagement through both the CA and EIA, and has been supported by a continually updated Stakeholder Engagement Workbook and Stakeholder Alignment Plan/Matrix, through which stakeholder engagement is tracked.

2.2 Consultation

The development of proposals for taking the Rev umbilical and pipeline out of service has recognised from the outset, that involving stakeholders as partners in the decommissioning journey would be valuable because of their respective areas of specialist knowledge and interest. The approach also acknowledges that engagement is only meaningful if it is based upon a genuine exchange of views and with the objective of influencing decisions and outcomes. Stakeholders have therefore been provided with information to enable discussion and comment in order to be certain that the basis on which decisions are taken is well-founded and properly informed. A description of the stakeholder engagement strategy and programme developed for the Rev UKCS Decommissioning Project is given in the Stakeholder Engagement Report that accompanies the Decommissioning Programme, with extracts information relating to key engagement activities relevant to the EIA presented below (Table 2.1). Where applicable stakeholder comments received as part of the Rev field EIA (as submitted to the Norwegian authorities and provided in Appendix A to this ES) have been included in Table 2.2 along with details on how these have been accounted for as part of this EIA. Note that at the time of the Rev field EIA, the field was under Talisman ownership.

Table 2.1 Summary of key stakeholder activities

Date	Engagement
Dec 2014	Proposed impact assessment for the decommissioning of the Rev field installations within the Norwegian sector sent for consultation to 35 Norwegian bodies; 6 of which responded with comments. Responses were reported in the Norwegian Impact Assessment report and a copy was forwarded to DECC in 2015; relevant responses to UKCS are included in Table 2.2.
Q1 2016	Meeting with the BEIS Offshore Decommissioning Unit (ODU) and Environmental Management Team (EMT) to discuss the proposed decommissioning project.
Q4 2016	Meeting with ODU.
Q1 2017	Meeting with EMT.
Q2 2017	Comparative Assessment Workshop attended by BEIS ODU, Scottish Fishermen's Federation (SFF) and JNCC (apologies received from Marine Scotland, SEPA and OGA). Feedback received in the workshop has been built into the CA process.

Table 2.2 Summary of stakeholder comments received for the Rev field Decommissioning Project with relevance to the Rev UKCS Decommissioning Project

Issue raised	Response from Norwegian Impact Assessment	Relevance and response in terms of the Rev UKCS Decommissioning Project
Norwegian Directorate of Fisheries		
Section 8.6 of Norwegian Impact Assessment (recommended decommissioning solution) states that it is planned to completely remove the seabed installations associated with the Rev field. The Norwegian Directorate of Fisheries welcomes this. It is also stated that, for the pipelines connected to the Rev field, various options have been evaluated. For options 1 and 3, on the other hand, buried pipes and cables between the Rev field and the Armada field will be left in situ. The Norwegian Directorate of Fisheries is generally sceptical of the current practice whereby pipes are left in place after the fields are decommissioned. It takes a very long time for pipes left in situ to decay naturally. Over time, two pipes left in place could be a hindrance to fishing with bottom fishing gear, and could also pose a risk to the safety of the vessel, even if the pipes were originally buried or made over-trawlable in some other way. We ask that possible removal of pipes etc. be examined after the closure of the Rev field.	Talisman notes the comments, but believes that leaving pipes and cables in place is less technically challenging and so constitutes less of a safety risk than removal. The total emissions into the air and the marine environment will also be lower if the fixtures are left in situ. Talisman will therefore follow established practice in the industry and leave buried pipes in situ. Exposed sections and pipes which are not buried will be removed. Talisman does not plan to examine this further.	The umbilical and 150 m of pipeline will be removed. The remaining 4.621 km of pipeline (in the UKCS) to be decommissioned *in situ* will be subject to overtrawling surveys and only where burial depth is not satisfactory (less than 0.6 m) will rock dump be used.
Norwegian Coastal Administration		
The Rev field is located in Block 15/12, roughly 6 km south of the Varg field, close to the border with the UK continental shelf.	In planning the activities on Rev, Talisman is taking account of its closeness to the UK continental shelf.	The scope of this EIA is the UKCS section of the Project and as such all potential impacts within UKCS are considered.

Issue raised	Response from Norwegian Impact Assessment	Relevance and response in terms of the Rev UKCS Decommissioning Project
The Norwegian Coastal Administration assumes that Talisman will establish sufficient contingency during the removal operation to minimise the risk of traces of oil products or other chemicals leaking out.	The removal operations are being planned to keep the risk of any accidental discharges to a minimum. The contingency plans for the field will be evaluated to ensure that the contingency is sufficiently robust during the removal operations.	The 12" export pipeline and the umbilical will be flushed and cleaned ahead of removal. The potential for residual discharge is considered in section 7 of this ES.
Norwegian Environment Agency		
In the opinion of the Norwegian Environment Agency, the most important foreseeable environmental effects of the various options have been explained in a satisfactory manner. There also appear to have been end-to-end assessments of the most relevant environmental aspects. The Norwegian Environment Agency has the following comment on the impact assessment: If there are to be operations with a risk of discharges of oil, the project should try to avoid periods in the winter time when there are expected to be large numbers of guillemots in the area.	The installations will be emptied of oil, cleaned and secured before removal to minimise the risk of discharges. The removal operations will have weather restrictions, making it advisable to implement the project in the summer.	The 12" export pipeline and the umbilical will be flushed and cleaned ahead of removal. The potential for residual discharge is considered in section 7 of this ES.
Norwegian Fishermen's Association		
The Norwegian Fishermen's Association welcomes the fact that most equipment will be removed when production on the Rev field ends. It is recommended that documentation should be produced (ideally using video) to show the state of the field after the installation has been removed.	Talisman confirms that there will be an inspection after removal to document that the area has been cleared as specified.	An overtrawling survey will be completed as part of the Rev UKCS Decommissioning Project. Following this monitoring surveys will be completed to ensure the seabed presents no snagging hazards for other sea users.
With regard to the pipes, the Norwegian Fishermen's Association disagrees with the established practice of leaving all or part of them in situ. It is clear that there are environmental concerns and other uses of the sea that should determine future disposal. That also means that socio-economic factors should be considered. But this	Talisman notes the comments, but believes that leaving pipes and cables in place is less technically challenging and so constitutes less of a safety risk than removal. The total emissions into the air and the marine environment will also be lower if the fixtures are left in situ. Talisman will therefore follow established practice in the industry and leave buried pipes in situ. Exposed sections and pipes which are not buried will be removed.	The umbilical and 150 m of pipeline will be removed. The remaining 4.621 km of pipeline (in the UKCS) to be decommissioned *in situ* will be subject to overtrawling surveys and only where burial depth is not satisfactory (less than 0.6 m) will rock dump be used.

Issue raised	Response from Norwegian Impact Assessment	Relevance and response in terms of the Rev UKCS Decommissioning Project
decommissioning process has not included a sufficiently good socioeconomic assessment of the costs, based on possible future fishing activity arising from the changes we are seeing in fish stocks (species and availability). The Norwegian Fishermen's Association also notes that there is a tendency for individual sections to become exposed, and Talisman believes this is best addressed by cutting up and rock-dumping these cutting areas. The Norwegian Fishermen's Association does not agree that this solves a future problem, and believes it is better to remove the pipes. The more areas have to be rock-dumped, the more areas could pose a risk of damage to fishing gear. The calculations of sustainability (lifetime) have been made under certain assumptions. When the date of a possible "collapse" in a pipe approaches, large parts of the continental shelf may become unusable by bottom-dragged gear. For this reason, active efforts should be made to find a technology that can easily remove pipes too.		

3 Project Description

3.1 Introduction

The following sections provide details on the Rev UKCS Decommissioning Project including consideration of alternatives, a description of the infrastructure to be decommissioned and the options that have been considered for the decommissioning of this infrastructure.

3.2 Consideration of Alternative Use

The Rev field started production in 2009 but production has decreased to the extent that the field now only produces intermittently (at times of appropriate reservoir pressure). Based on the periodic nature of production of the Rev Field, the rights holders (Repsol and Petoro AS) are planning to cease operation of the field. Following cessation of production, options to re-use the infrastructure *in situ* for future hydrocarbon developments have been considered, but to date, none have yielded a viable commercial opportunity. There are a number of reasons for this, including the absence of remaining hydrocarbon reserves in the vicinity of the Rev subsea infrastructure, and the limited remaining design life of the Rev subsea infrastructure.

3.3 Scope of Proposed REV UKCS Decommissioning Project

As previously described, there is infrastructure associated with the Rev field, in both the UK and Norway sectors of the North Sea. The UKCS components (the Rev UKCS Decommissioning Project), which are the subject of this EIA, are detailed in section 1.3.4.

The scope of work for the UK sector includes:

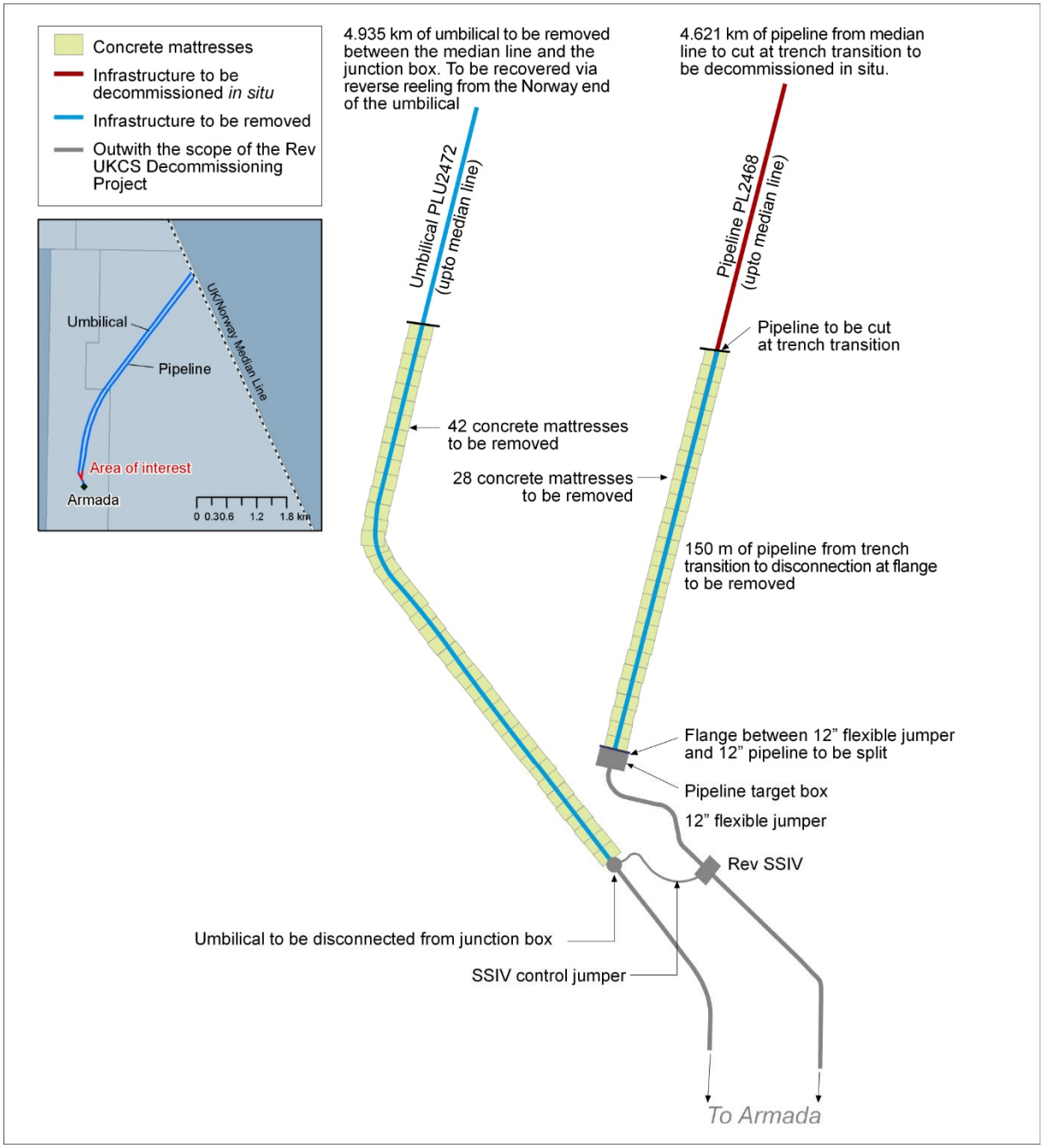
- Pipeline
  - Remove all concrete mattresses from the SSIV to where the pipeline is trenched and back filled. There are approximately 28 concrete mattresses to be recovered;
  - Cut the 12" pipeline where the pipeline enters the trench and rebury the pipeline end; and
  - Split the flange between the 12" flexible jumper and the 12" pipeline and recover the 12" pipeline section (including the pipeline end flange) to the cut.
- Umbilical
  - Remove all mattresses from the junction box to where the umbilical is trenched and back filled. There are approximately 42 mattresses to be recovered;
  - Disconnect the umbilical from the junction box; and
  - The umbilical will be cut (in Norway waters) and removed using reverse reel onto a vessel.

Figure 3-1 illustrates the infrastructure which comprises the Rev UKCS Decommissioning Project.

3.3.1 UK – Norway transition

The focus of this ES is the UK continental shelf aspect of the Rev Decommissioning Project, it is therefore important to know where the transition point from UK to Norway is for the relevant infrastructure. For the 12" export pipeline the transition between the UK and Norway is at approximately 433 900E/6.428 900N. For the umbilical the transition point is at approximately 433 850E / 6 429 100N.

Figure 3-1 Infrastructure to be decommissioned as part of the Rev UKCS Decommissioning Project



3.4 Description of Infrastructure and Materials Inventory

A simplified schematic of the Rev infrastructure has been provided in Figure 1-3.

3.4.1 Overview of Rev infrastructure to be removed in Norway (outwith EIA scope)

The following infrastructure occurs within the Norwegian sector of the Rev Decommissioning Project. The decommissioning of this infrastructure is out with the scope of this EIA, but an overview is given in order to form a clear understanding of the project:

- Rev South development structure: consists of the well head protection structure (WHPS) and Rev pipeline end manifold protection structure (PLEM PS). Both consist of four legs, four suction anchors and a protective top unit;
- Rev West WHPS: consists of four legs with four suction anchors and a protective top unit;
- Varg gas export PLEM: covered with Glass Reinforced Plastic cover which is stabilised by rock berm;
- Varg gas export flexible flowline;
- Rev 6'' flexible jumper;
- 10'' Varg gas export jumper: the VGE jumper;
- 6'' Varg gas export flowline;
- Rev electrical and hydraulic jumpers; and
- 16 GRP protection covers.

3.4.2 Infrastructure to be removed as part of the Rev UKCS Decommissioning Project (within EIA scope)

3.4.2.1 Rev to Armada 12" export pipeline

The 12'' export pipeline is a rigid pipe between the Rev well locations and the Armada Platform with a diverless 10 k American Petroleum Institute (API) flange at the Armada end. The API flange on the Armada end of the flowline is tied into the 12" flexible jumper going to the Rev SSIV. Table 3.1 contains details of the features of the 12" export pipeline. The pipeline is trenched and naturally back filled and protected by concrete mattresses between the SSIV and the trench transition.

Table 3.1 Components of the 12" export pipeline

Component products	Unit	Value
Length	km	4.771
Diameter	mm	323.8
Wall thickness	mm	22.2
Material	DNV-OS-F101 (offshore standard for pipelines)	SML 450I SUPD (X65)
Weight	kg/m	Steel: 173 Plastic: 21
Specified minimum yield strength (SMYS)	MPa	448
Coating	mm	PP 39.6 mm

3.4.2.2 Rev electro-hydraulic-chemical (EHC) umbilical

The umbilical is initiated with a J-tube pull-in at the Armada platform. The umbilical is installed in a trench between Armada and Rev and protected by concrete mattresses until the umbilical enters the trench at the Rev and end. Table 3.2 provides details on the features of the umbilical.

Table 3.2 Components of the umbilical

Component Products	Unit	Value
Length	km	4.935
Diameter	mm	158.5
Weight (nominal mass)	kg/m	Plastic: 30 Copper: 8
Master boot record (storage)	m	2.5
Bending stiffness at 20 C°	kNm2	12.1
Minimum breaking load	Te	82.4
Allowable compression	kN	5
Allowable crush load	Te/m	15

3.4.2.3 Installed status of 12" export pipeline and umbilical

Table 3.3 summarises the installed status of the pipeline and umbilical.

Table 3.3 Installed status of the pipeline and umbilical

Asset location	Service	Installation	Length	Size
Rev PLEM Rev SSIV	Gas/condensate production line	Trenched and natural backfill	4.771 km (in scope) (9.1 km in total)	12"
Armada junction box to Rev wells	Umbilical	Trenched and natural backfill	4.935 km (in scope) (9.8 km in total)	6"

The 12" pipeline was trenched with a minimum depth of cover (DoC) of 1.0 m at installation with the majority buried to a depth of 1.5 – 2 m. The umbilical was installed to a minimum trench depth of 1.2 m and the trench allowed to naturally back fill. Burial was slow to begin with and has only reached a maximum burial depth of 0.2 – 0.3 m in the UKCS, with some areas having almost zero burial.

3.5 Preparation for Decommissioning

The infrastructure system will be cleaned in accordance with established procedures for final disposal. The cleaning process will conform to the industry standard, to ensure that the lines are adequately cleaned. Flushing and cleaning will be managed in environmental terms under relevant regulations (e.g. Offshore Chemical Regulations 2002 (as amended), Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended)) and though the application of permits for the

relevant infrastructure (Rev or Armada) this may be under existing permits, under existing permits with amendments, or under new permits. Whilst the flushing and cleaning of the flowlines and umbilicals are out of scope of the EIA, potential impacts associated with the decommissioning of the lines is within the scope (e.g. discharge during removal and long-term release from any lines decommissioned *in situ*).

Cleaning of the export pipeline and umbilical involves propelling a volume of gel plug through the pipe followed by flushing with seawater equal to three times the volume to remove any debris or build up from inside the pipe. Flushing and cleaning aims to reduce the oil and chemical content of the fluids in the export pipeline and umbilical to a target cleanliness at which no environmental harm will result when containment is broken prior to decommissioning. Flushing and cleaning will also ensure minimal residue remaining on walls of the export pipeline which could be released as the pipeline wall deteriorates *in situ*. Following flushing and cleaning the pipeline and umbilical will be left unsealed and will therefore fill with seawater.

If the desired degree of cleanliness is not achieved, other methods will be considered. Disposal of oily waste from cleaning will be at the Armada platform in the UKCS or via injection into a Rev well in the Norwegian sector. Alternatively, oily waste could be taken onshore for disposal.

3.6 Option Selection

3.6.1 Comparative assessment process

CA is a process by which decisions can be made on the most appropriate approach to decommissioning. As such, it is a core part of the overall decommissioning planning process being undertaken by Repsol for the Rev UKCS Decommissioning Project. Guidelines for CA were prepared in 2015 by Oil and Gas UK (OGUK), where seven steps to the CA process were recommended.

Repsol has already conducted a CA of options for the decommissioning of infrastructure in the Norwegian sector using multi-criteria decision analysis. Repsol is now undertaking a similar assessment for the UK infrastructure, and a workshop was held in Q1 2017. As advised by BEIS, the CA will consider the context of the entire decommissioning project, albeit with a specific focus on the UKCS where appropriate. As required under the Petroleum Act 1998, all feasible decommissioning options are being considered in order to arrive at the best decommissioning option for the pipeline and umbilical. The CA will examine and compare each option.

Under the BEIS decommissioning guidelines (DECC, 2011) this infrastructure is a candidate for decommissioning *in situ* (section 1.5) for each of the decommissioning options data or assessment will be presented on:

- Technical feasibility and risk;
- Safety;
- Environmental impact;
- Societal impact; and
- Economics.

Within the CA report, a full inventory of all infrastructure to be decommissioned will be provided which details individually the following:

- Pipeline number;
- Type of line (e.g. pipeline, flow lines, spool piece etc.);
- Duty (e.g. gas export, condensate, water injection etc.); and
- Material, diameter, wall thickness and coatings (where applicable).

3.6.2 Options for decommissioning

In line with the latest BEIS guidelines on decommissioning (DECC, 2011), Repsol undertook CA in order to arrive at a decision for the decommissioning method of the subsea infrastructure. The CA focussed on two decommissioning options for the export pipeline and three decommissioning options for the umbilical. An overview of the options is presented in Table 3.4.

Table 3.4 Decommissioning options considered as part of CA

Infrastructure	Option 1	Option 2	Option 3
Export pipeline	Full removal of pipeline. The pipeline will be cut into a number of suitably sized segments and lifted from the seabed to the vessel. No infrastructure would remain.	Decommission *in situ*. Dredging to approximately 1 m below the seabed to cut and remove pipeline ends which will be brought to shore. Potential for rock dump on areas of burial of less than 0.6 m and exposed ends.	N/a
Umbilical	Full removal using reverse reeling onto vessel. Ends of umbilical will be cut and reverse reeling will occur from the Rev end (in the Norwegian sector) of the umbilical. No infrastructure would remain.	Decommission *in situ*. Ends of umbilical will be cut and removed and rock dump will be carried out to cover exposed ends.	Decommission *in situ*. Ends of umbilical will be cut and removed and rock dump will be carried out to cover exposed ends and additional rock dump will be used to increase the burial depth.
Shaded cells represent the chosen options for decommissioning of infrastructure.			

The conclusion of the CA for the decommissioning of the export pipeline was Option 2 (decommissioning *in situ* with removal of ends) ranked the most highly. For the decommissioning of the umbilical, Options 1 and 2 ranked very closely with a difference of only 0.19% in terms of preference (taking into account societal, technical, environmental, economic and safety factors). The option which ranked the highest was Option 2 (decommissioning *in situ* with removal of cut ends). This option would mean the umbilical remains buried in the trench and would require future monitoring in order to assure the umbilical remained at an acceptable burial depth of 0.6 m. In order to preserve this depth it is possible that future remedial work would be needed in the form of seabed maintenance or rock dump. Given the BEIS guidelines preference is full removal of infrastructure and the likelihood of future seabed disturbance as a result of Option 2, Option 1 (full removal by reverse reeling) was selected as the preferred option for the umbilical.

3.6.3 Decommissioning activities

3.6.3.1 Schedule

Repsol anticipates executing the Rev UKCS Decommissioning Project from 2021 - 2022; an indicative schedule for the work is shown in Figure 1-4. At this stage exact timings are unknown.

3.6.3.2 Vessel requirements

Repsol will select one or more subsea contractors to mobilise a fleet of vessels with a range of capabilities:

- Cranes for lifting objects of different sizes and weights off the seabed;
- Capability to support underwater operations (including Remotely Operated Vehicle (ROV) deployment, cutting, excavation and rock placement); and
- Survey vessels.

The vessels will deploy ROVs to disconnect the subsea infrastructure as required. Cranes on board the vessels will lift removed infrastructure onboard as required. Vessels to be used during the Rev UKCS Decommissioning Project are detailed in Table 3.5.

Table 3.5 Vessels to be used during the Rev UKCS Decommissioning Project

Vessel type	Decommissioning activity	Approximate number of days		
		Mobilisation/de mobilisation	In transit	In the field
Offshore Construction Vessel (OCV)	Decommissioning 12" export pipeline	1	2	2
	Decommissioning of umbilical	1	2	5
Trawler	Over trawling survey post decommissioning	1	2	1
Survey vessel	Monitoring surveys post decommissioning*	3	6	3
Total		**29 vessel days**		

* Assuming one survey immediately after decommissioning and two further at three year intervals.

Note: Vessels associated with flushing and cleaning are outwith scope and therefore not included here.

Decommissioning of the export pipeline (including removal of concrete mattresses) and decommissioning of the umbilical (including concrete mattress removal) have been considered independently in terms of vessel requirements. It has been considered that the two events will occur at different times. If there is the need for any rock dump in the decommissioning of the export pipeline this will occur from the OCV as the volume will be minimal and there will be no requirement for a separate rock dump vessel. The use of an ROV has not been considered in terms of vessel use as it is assumed that this will be transported on the OCV. An overtrawling survey and a monitoring survey will occur immediately following decommissioning activities. Following this two further monitoring surveys will occur at three year intervals to monitor the seabed. It is anticipated the environmental impact will be minimal enough to negate the requirement for further surveys, however this cannot be confirmed until the results of the proposed surveys are assessed. The exact survey scope will be determined in consultation with ODU and their consultees.

The infrastructure lifted from the seabed will be transported to an onshore dismantling site by the vessels described above.

3.6.3.3 Destination and quantities of infrastructure to be decommissioned

As part of the Rev UKCS Decommissioning Project some infrastructure will remain *in situ* whilst other infrastructure will be fully removed. A final decision on the destination of the infrastructure which is fully

removed is yet to be made, the onshore dismantling and recycling facilities will be located in either Norway or the UK. Details of the quantities of infrastructure to be decommissioned are detailed in Table 3.6.

Table 3.6 Quantities of infrastructure to be decommissioned

Infrastructure	Quantity/details	
	To be left *in situ*	**To be brought ashore for disposal**
12" export pipeline	4.621 km (896,474 kg)	0.15 km (29,100 kg)
Umbilical	Nothing to be left *in situ*	4.935 km (223,554 kg)
Concrete mattresses	Nothing to be left *in situ*	70 in total (28 to be removed from export pipeline and 42 from umbilical). Each mattress is 6 m x 3 m x 0.15 m and weighs 4,700 kg. Total weight of mattresses brought back to shore is 329,000 kg

3.6.3.4 In-situ (partial removal) decommissioning of the 12" export pipeline

The 12" export pipeline is currently trenched and rock-dumped for the majority of its length. Concrete mattresses are in place on unburied sections. It is anticipated that 28 concrete mattresses will be removed (Figure 3-2). For the removal of the pipeline end, the pipeline will be cut at the trench transition end of mattresses and just behind the end fitting of the flexible jumper using hydraulic shears. A cofferdam and ROV will be utilised in cutting the pipeline. The export pipeline line will be cut into manageable lengths of approximately 15-20 m, the cut sections shall be recovered using a hydraulic lifting beam to lift onto the deck of the OCV. The exposed pipeline end will be reburied by ROV utilising the material that was originally burying the pipeline.

Figure 3-2 Illustration of multiple mattresses being lifted from the sea floor (system shown from Subsea Protection Systems, 2017)

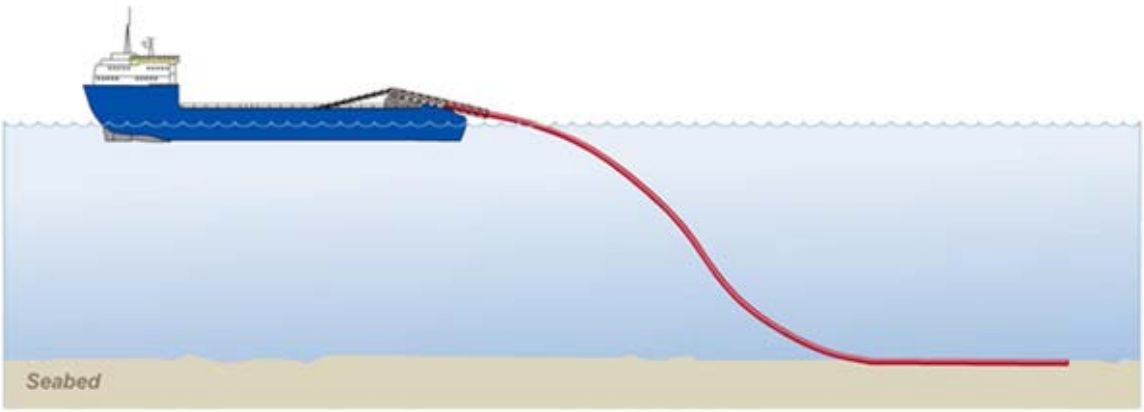
3.6.3.5 Rock dump

Repsol's preferred approach to decommissioning the 12" export pipeline *in situ,* is to not use any rock dump. However there is a possibility that a very small volume of rock dump will be required to cover the cut end of the pipeline at the trench transition if it is not possible to rebury after cutting and the pipeline end is exposed. It may also be necessary to use rock dump to cover any areas of low burial along the pipeline left i*n situ.* However a recent pipeline inspection survey (Deep Ocean, March 2017) has indicated the minimum burial depth of the pipeline to be 1 m with the remainder being buried between 1 and 2 m and an average burial depth of 1.5 m therefore negating the requirement for rock dump. The need for rock dump will be confirmed during decommissioning activities. Rock dump will ensure that the seabed is left in a condition which does not pose a risk to commercial fishing.

3.6.3.6 Umbilical

The trenched and buried umbilical is to be completely removed. Following removal of 42 concrete mattresses, the umbilical will be disconnected from the junction box at the Armada end and will be cut at the Rev end in Norwegian waters. A recovery head will be attached to the umbilical (this tool allows a firm hold to be made on the umbilical) at the Rev end and then the reverse reeling will be initiated. The process of reverse reeling is shown in Figure 3-3.

Figure 3-3 Illustration of an umbilical being recovered to a vessel in a process called 'reverse reeling'



3.6.3.7 LSA / NORM

Once recovered to the deck of the vessel, pipeline sections would be checked for the presence of Low Specific Activity (LSA) scale. LSA is a radioactive deposit which can occur in pipelines and consists of carbonates and sulphates of Calcium, Barium and co-precipitated Radium. LSA is described as a type of Naturally Occurring Radioactive Material (NORM). Appropriate handling facilities will be required for the management of any LSA/NORM scale found to be above the regulatory thresholds.

3.6.3.8 Legacy requirements

Pipelines located on the UKCS and decommissioned in-situ, either on the seabed (rock-dumped) or buried in a trench, must be followed by a suitable long term monitoring programme agreed with ODU and in consultation with other Government Departments.

3.6.3.9 Recovered structures pipelines and umbilicals – onshore

The Rev UKCS Decommisioning Project structures and equipment removed from the seabed will be delivered to one or more onshore dismantling sites. Although the dismantling site(s) has not yet been selected, it/they will be chosen from a shortlist of existing onshore disposal yards and no new facilities will be required. At the dismantling site(s):

- If there is significant marine growth that has not fallen off subsea structures during removal and transit, this will be removed and sent for appropriate disposal;
- Equipment suitable for reuse will be segregated;
- Pipework that has been in contact with hydrocarbons and potentially contains NORM will be assessed, and removed to a licensed facility if decontamination is necessary;
- The recovered umbilical may be stripped to recover copper cable and other recyclable materials; and
- Recovered concrete will be segregated and stockpiled. The concrete will be sent for crushing and use as aggregate in new concrete where possible.

Management of waste is detailed in section 13.

3.7 Post Decommissioning Surveys

Debris clearance will be carried out immediately following the Rev UKCS Decommissioning Project to remove any debris which has arisen from the decommissioning operation or from past development and production activity. An appropriate vessel will then be engaged to verify that the seabed has been left in a condition that does not present a hazard for commercial fishing. This process, called overtrawling, will involve towing a chain mat (Figure 3-4) across the area of the Rev UKCS Decommissioning Project. Final decommissioning activities will be considered to be complete only subject to certification of seabed clearance by the Scottish Fishermen's Federation (SFF) (or a similarly qualified body) and acceptance of the Decommissioning Close-out Report by BEIS.

In addition to the debris clearance and overtrawling a post decommissioning environmental seabed sampling survey will be undertaken to report levels of hydrocarbons, heavy metals and other contaminants in the seabed sediment and biota. The survey strategy will be developed in cosultation with ODU

Figure 3-4 Chain mat shown on the quayside (system shown from SFF, 2016)

3.8 Monitoring

Long-term liability survey monitoring will be undertaken as required by BEIS for the infrastructure decommissioned *in situ*. The frequency and nature of any monitoring required is likely to be determined through a risk-based approach based on the findings from each subsequent survey. For the purposes of this assessment, it has been assumed a further monitoring survey after a period of three years. A further survey will be carried out after a further three year interval, it is anticipated that there will be no requirement for further monitoring surveys after this, but as stated this requirement will be decided in consultation with ODU and their consultees and assessment of survey results.

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4 Environmental Management

4.1 Introduction

Beyond the main period of preparation for decommissioning and the actual decommissioning activities, the Rev UKCS Decommissioning Project has limited activity associated with it (there are likely to be a small number of post-decommissioning surveys). The focus of environmental performance management for the Project is therefore to ensure that the activities that will take place during the limited period of decommissioning happen in a manner acceptable to Repsol (and to stakeholders). The primary mechanism by which this will occur is through Repsol's Environmental Management Policy and specifically through the EMS that it requires be operational.

4.2 Environmental Policy, Management System and Management Plan

Repsol is committed to conducting its activities in a manner that incorporates health, safety and environmental protection as core values. To achieve this commitment Repsol is guided by the following principles which are set out in the Repsol Health, Safety and Environment Policy.A copy of the policy is shown in Figure 4-1.

4.3 Contractor Management

A Project Management team will be appointed to manage suitable sub-contractors for the removal of the Rev UKCS Decommissioning Project. Standard procedures for operational control and hazard identification and management will be used. The Management team will monitor and track the process of consents and the consultations required as part of this process. Any changes in detail to the offshore removal programme will be discussed and agreed with BEIS.

4.4 Onshore Management

There is the potential for the onshore phase of decommissioning to interact with communities in the vicinity of the dismantling yard(s). The onshore location(s) have yet to be confirmed, but locations within and outside of the UK may be considered. Whether in or outside of the UK, dismantling will be carried out at sites which will have in place site management plans and the correct licences for the proposed dismantling operations and as such will limit potential impacts to local communities. The site(s) selected for decommissioning activities will have in place correct and up to date licences for operation and relevant site management plans. These will ensure operations on site minimise any potential impacts to the local community. For example, specific requirements are likely to include:

- Noise will be managed as part of the onshore dismantling contract and as part of the selection process for the dismantling yard, noise management will be taken into consideration. Noise emitting activities should not occur at particularly sensitive times such as early morning and late night;
- In order to mitigate odour from marine growth (if there is significant growth on infrastructure returned to shore), Repsol will require selection of a dismantling yard that has procedures in place to dispose of marine growth in a manner that will avoid odour nuisance occurrences. This could take the form of an odour management plan being in place within the dismantling yard, management measures could include rapid removal of marine growth and spraying of odour suppressants;
- Repsol may require that onshore dismantling yard/s conduct a review of records of engagement with communities and close-out any outstanding issues; and
- Environmental auditing may occur as part of the tendering process for the work.

Figure 4-1 Repsol HSE policy

Policy of Health, Safety and Environment

Repsol is committed to conducting its activities in a manner that incorporates health, safety and environmental protection as core values. To achieve this commitment Repsol is guided by the following principles:

Leadership and culture

The Executive Committees will lead the health, safety and environmental programs, considering them as a priority in its decision-making and planning, and allocating the necessary resources to make sure that all employees have the necessary skills and work in accordance with the established principles.

The Company's top management will promote a culture of safety and environment that encourages proper risk perception, transparency and confidence in reporting, continuous learning and innovation.

Inclusion of health, safety and environmental criteria in the complete business cycle

Repsol will ensure that risk and impacts proactive management is incorporated throughout the full life cycle of its operations in order to prevent personal injuries and damages to the assets and the environment.

Integrated Management

Line management will integrate health, safety and environment in the management of the business and will be responsible for the implementation of the management system and to obtain the established results.

Compliance with standards

Repsol will comply with the law and established internal standards across all geographic areas, which are designed to take into account the trends in legislation and international standards. Repsol will plan its strategies in accordance to it.

Continuous improvement

Repsol will systematically establish goals and objectives for continuous improvement in health, safety and environmental protection. Repsol will evaluate performance against these objectives, applying the necessary corrective measures, and implementing verification, audit and control processes in order to achieve the desired goals.

Communication and stakeholders relations

Repsol will maintain regular communication with stakeholders and will work with local communities and the society sharing its knowledge and reporting in a trustworthy and transparent manner.

All employees, contractors, secondees and interns, no matter what their position or geographic location, are responsible for their own safety and shall contribute as individuals and collectively, to the health, safety and environmental performance, and be in compliance with this policy.

In case of conflict between safety and operational results, all employees, contractors, secondees and interns, have the responsibility to choose safety, and the Directorate will support that choice.

Josu Jon Imaz San Miguel,
Chief Executive Officer
On November 17, 2015

4.5 Environmental Monitoring

An overtrawling survey with chain mat and seabed monitoring survey will be carried out immediately following decommissioning to ensure the seabed does not pose a risk to commercial fishing in the area. Seabed monitoring will subsequently be carried out at three year intervals to ensure the seabed remains in a favourable condition for commercial fishing. It is anticipated that the impact from the Rev UKCS Decommissioning Project will be minor enough to allow the cessation of monitoring activities following three seabed monitoring surveys (after a period of six years following decommissioning) but this will be decided on analysis of each survey report and in consultation with BEIS.

4.6 Environmental Awareness and Training

Ahead of mobilisation of personnel and vessels involved with the Rev UKCS Decommissioning Project, HSE talks will be given to all relevant parties to ensure the key principles of the Repsol HSE policy are followed and that contractors are aware of any Project specific management and mitigation requirements.

4.7 Scottish Marine Plan

In addition to considering environmental performance in the execution of the Project, Repsol has considered Project strategy in the context of the objectives and marine planning policies of the Scottish National Marine Plan. Repsol considers that the Rev UKCS Decommissioning Project is in broad alignment with such objectives and policies; the extent to which the Project is aligned with oil and gas objectives and policies that are relevant to decommissioning is summarised in Table 4.1.

Table 4.1 Alignment between the Project and the Scottish National Marine Plan

Objective/policy	Project details
Maximise the recovery of reserves through a focus on industry-led innovation, enhancing the skills base and supply chain growth.	The Rev field has extracted hydrocarbons to the point that maximum economic recovery has been achieved. The decommissioning activities will provide high-skilled work in an emerging industry.
An industry which delivers high-level risk management across all its operations and that it is especially vigilant in more testing current and future environments.	Extensive mitigation measures and response strategies have been developed for identified risks.
Where possible, to work with emerging sectors to transfer the experience, skills and knowledge built up in the oil and gas industry to allow other sectors to benefit and reduce their environmental impact.	The Project will draw on experienced engineers, environmental specialists and other groups that are not necessarily limited to oil and gas experience.
Where reuse of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations. Reuse or removal of decommissioned assets from the seabed will be fully supported where practicable and adhering to relevant regulatory process.	Full consideration to all available decommissioning options, including reuse and removal, as part of the development of the Project.
Consenting and licensing authorities should have regard to the potential risks, both now and under future climates, to oil and gas operations in Scottish waters, and be satisfied that installations are appropriately sited and designed to take account of current and future conditions.	The proposed activities have been developed in a way that there will not be a significant impact on the physical, biological and socio-economic environment, now or in the longer-term.
Consenting and licensing authorities should be satisfied that adequate risk reduction measures are in place, and that operators should have sufficient emergency response and contingency strategies in place that are compatible with the National Contingency Plan and the Offshore Safety Directive.	Potential environmental impacts have been reviewed as part of this EIA and relevant mitigation measures developed.

5 Environmental Baseline

5.1 Introduction

It is important in any EIA process that the main physical, biological and socio economic sensitivities of the receiving environment are well understood. As such, this section describes the main characteristics of the environment in and around the Rev infrastructure in the UKCS and highlights the key sensitivities. Wider contextual information on the Rev field as a whole is available in the Norwegian sector EIA at Appendix A.

The EIA must understand the sensitivity, vulnerability and value of receptors to be able to define the magnitude of any potential impact. This baseline provides the information that the impact assessments in sections 7-12 use to define such variables.

5.2 Data Gaps and Uncertainties

The North Sea has been extensively studied, meaning that this EIA has been able to draw on a significant volume of published data. This bank of published data has been supplemented by historic surveys carried out in and around the Rev UKCS Decommissioning Project ensuring a robust baseline is available against which to assess impact.

5.3 Data Sources

This section draws on a number of information sources including published papers, relevant strategic environmental assessments (SEAs) and site specific investigations. Key studies used to inform this environmental description include:

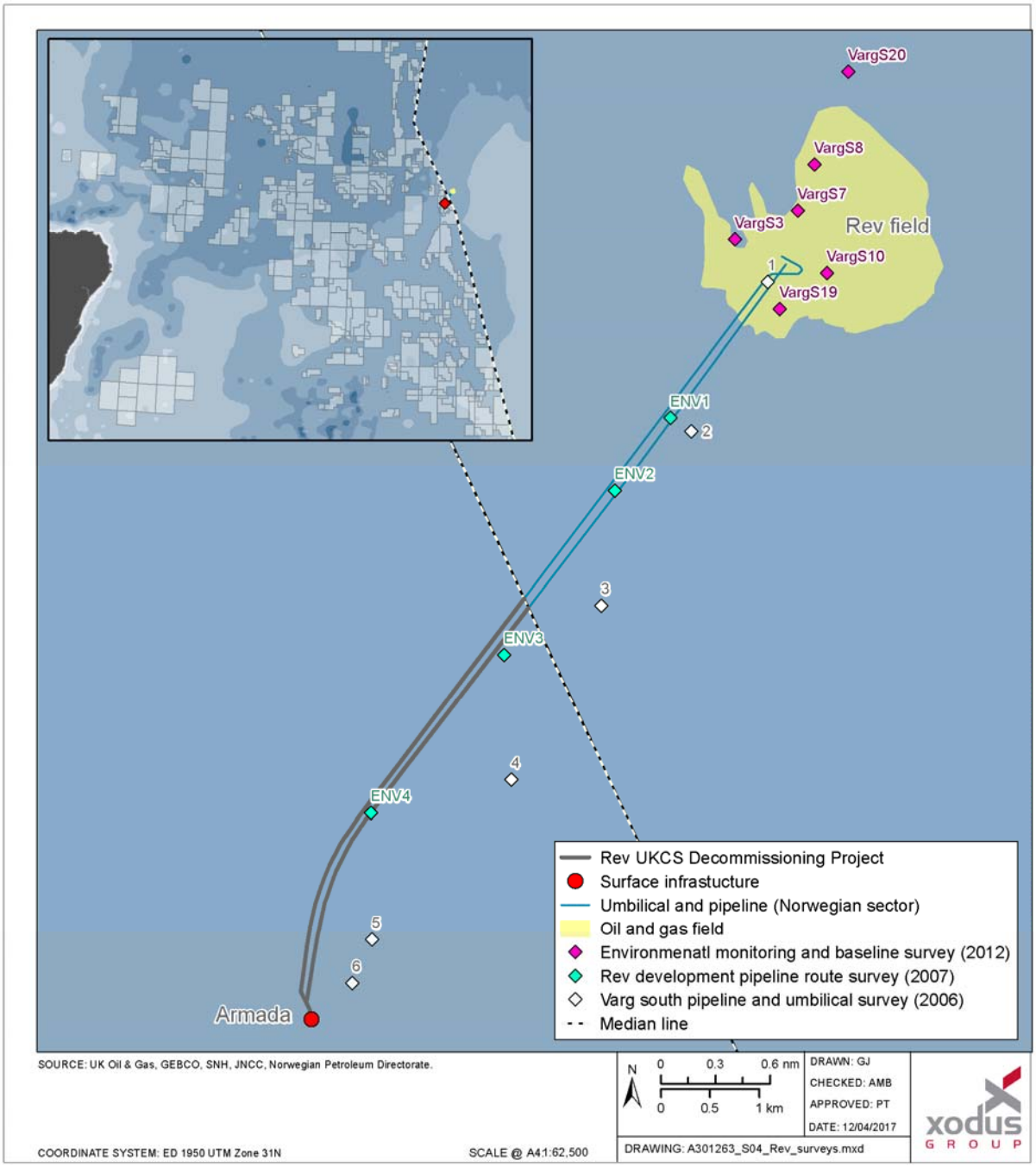
- Offshore Energy SEA 3' (DECC, 2016);
- 'Scotland's National Marine Plan' (Scottish Government, 2015) and its interactive online data resource (NMPI, 2016);
- The 'Offshore Seabird Vulnerability Assessment' (Joint Nature Conservation Committee (JNCC) 1999);
- Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK Hi Def (2016); and
- 'Small Cetacean Abundance in the North Sea' (SCANS) and 'Small Cetaceans in the European Atlantic and North Sea' (SCANS-II) projects (JNCC, 2010, Hammond *et al*., 2013).

There have been no site specific surveys carried out specifically for the Rev UKCS Decommissioning Project. However there are a number of surveys have previously been carried out in the area which are considered to provide a good indication of the current bathymetry and seabed conditions at the project site (Table 5.1).

Table 5.1 Surveys in the vicinity of the Rev UKCS Decommissioning Project

Survey/Report	Details
Fugro Ltd, (2006) Pipeline and umbilical route survey NOCS Block 15/12 & UKCS Block 22/15 Varg South Development. Report No. 8670.8V3.1 Volume 3: Environmental Baseline Survey	Geophysical: A 9.22 km x 0.5 km survey corridor between Varg South (now Rev field) and the Armada Platform. Environmental baseline: In total, 6 environmental sampling stations were investigated, with 4 grabs and 1 camera deployment conducted at each station. Underwater photography was also undertaken. Although the final installed pipeline between Rev and Armada took a different route to the north, these survey data provide an indication of the physical and biological characteristics of the Project area.
Det Norske Veritas, (2013) Environmental monitoring and baseline surveys in region II 2012	The purpose of the regional survey was to study the environmental impacts from petroleum activities at each field in the Sleipner area. Regional sediment monitoring in the Sleipner area was first implemented in 1997. A total of 18 fields, from Rev in the south to Vale in the north, were surveyed. The survey included sampling of sediments for physical, chemical and biological analyses. The report summarizes the results from the chemical and physical analyses of the seabed sediments as well as analyses of the benthic macro fauna community in Region II.
Rev Development Gardline, (2007a) Rev Development Pipeline Route Survey UKCS 22/5 & NCS 6/3 715/12. February 2007 - Environmental Baseline Report	The objective of the survey was to assess the seabed conditions along the proposed pipeline and umbilical route. Four stations were sampled (grab samples and video/stills) at 1-2 km intervals along the route.
Gardline, (2007b) Rev Development Pipeline Route Survey UKCS 22/5 & NCS 6/3 715/12. February 2007 - Survey Report	The objective of the survey was to determine the suitability of the proposed route and to identify any shallow geological or bathymetric features which could impair pipe lay or trenching. The following survey techniques were used: multi beam swathe survey, sidescan sonar, sub bottom profiler, magnotomter.

Figure 5-1 Location of survey stations from previous surveys carried out in the vicinity of the Rev UKCS Decommissioning Project

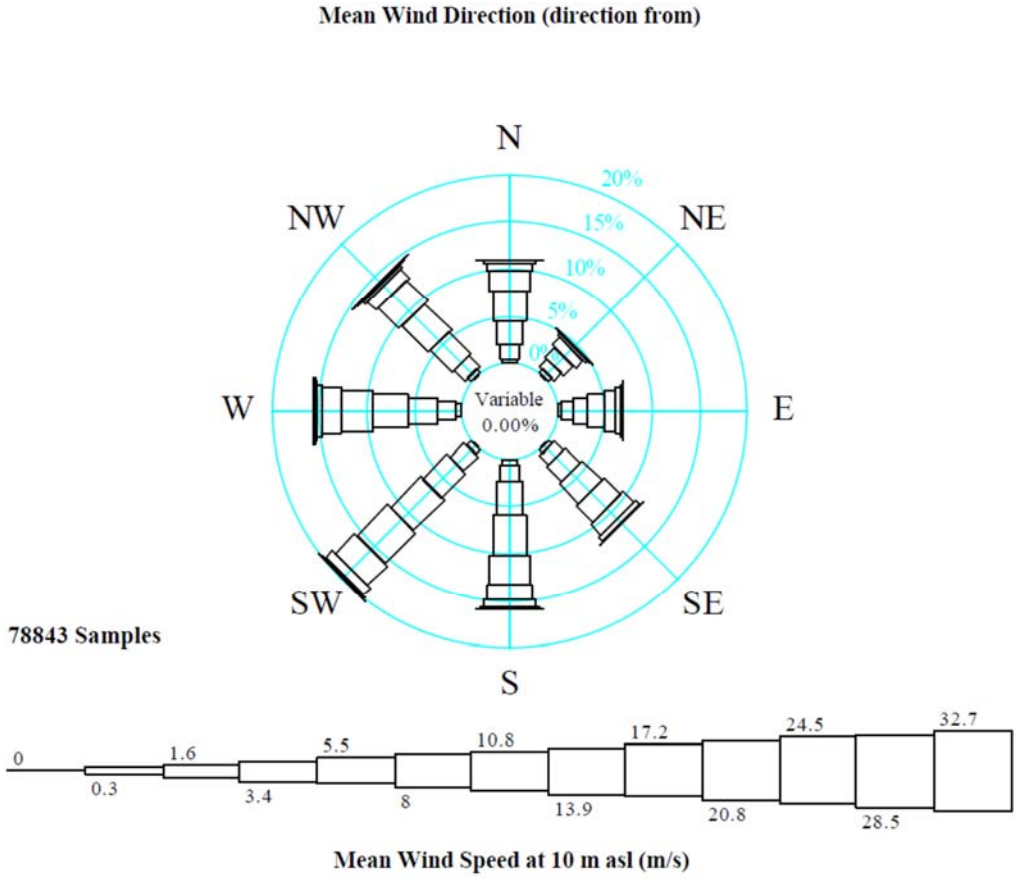


5.4 Physical Environment

5.4.1 Weather and sea conditions

Meteorological Office wind data for the central North Sea region (1854 – 1994) an data collected as part of the North European Storm Study (NESS) show southerly and south-south-westerly winds prevailing, with average wind speeds throughout the year of 6 – 13 m/s representing moderate to strong breezes (DTI, 2001, Fugro, 2001).

Figure 5-2 Wind speed and direction in the vicinity of the Rev UKCS Decommissioning Project



5.4.2 Currents

Atlantic Water enters the North Sea from Shetland and via the Fair Isle Channel, driving an anti-clockwise circulation in the central North Sea. The mean spring tidal range at the Rev field is in the range 0.1 – 1 m (NMPi, 2016).

5.4.3 Wave height

The Scottish National Marine Plan (NMPi, 2016) reports the average wave height of the Rev field to be 2.1 – 2.4 m whilst the annual mean wave power ranges from 18.1 – 24 kW/m. Peak kinetic energy at the seabed due to waves in the area is classed as moderate (0.21 – 1.2 N/m2; McBreen *et al.*, 2011).

5.4.4 Water temperature and salinity

The offshore central North Sea becomes thermally stratified in spring when air temperatures increase. A thermocline between warm surface waters and colder deeper waters develops below 30 m depth. Marex (1993) reports surface temperatures in the range 10 – 16.5°C, with a mean summer surface temperature of 13.5°C, whilst the water temperature at the seabed was in the range 5.1 – 11.6°C, with a mean summer seabed temperature of 6.9°C. Stratification breaks down in autumn as more frequent and severe storms mix the water column and cool the water (van Leeuwen *et al.*, 2015). Surface salinity at the Rev field varies from 34.5‰ in winter to 35.0‰ in summer (NMPi, 2016).

5.4.5 Bathymetry and Seabed Conditions

In 2007 a geophysical survey was carried out along the proposed Rev pipeline route from the Rev wells to the Armada platform. This survey incorporated the area now occupied by the pipeline and umbilical, which comprise the Rev UKCS Decommissioning Project (Gardline, 2007a&b).

The seabed in the area of the Rev UKCS Decommissioning Project was described as relatively flat and smooth with only occasional undulations (Gardline, 2007a). The survey stations from this survey are shown in relation to the bathymetry in the survey area in Figure 5-3. The bathymetry recorded in the 2007 survey is in line with the results of the 2006 Varg pipeline survey (including the pipeline route in the area of the Amada platform) which found bathymetry across the majority of the proposed Varg pipeline route varied little, from a maximum depth of 89m to the southwest of the survey area to 86 m in the northeast (Fugro Ltd, 2006).

The 2007 Rev pipeline route survey reported that seabed sediments comprised fine to medium silty sand, with the sand being present as a veneer over firm gravelly, sandy clay. Where the veneer is shallow clay patches are exposed (Gardline, 2007a). A number of sonar contacts were identified in the area of the Rev UKCS Decommissioning Project, the majority of which were interpreted as boulders. No magnetic anomalies were recorded (Gardline, 2007a). Example images of seabed sediments recorded at station ENV 4 are shown in (Figure 5-4 . The 2012 regional surveys reported that sediments at the Rev field consist of fine sand with a low organic content (DNV, 2012). The Varg pipeline survey in 2006 reported seabed sediments in the area of the Armada platform to be predominantly shelly sand, with a number of areas of gravelly sand with occasional clay exposures.

Particle size analysis of samples in the 2007 Rev pipeline survey reported that the mean size of sediment particles at the sampling stations in close proximity to the Rev UKCS Decommissioning Project was 0.2 mm (Gardline, 2007b). Particles from survey station 6 (6 being the closest station to the Rev UKCS Decommissioning Project, Figure 5-1) of the 2006 Varg pipeline survey also had a mean size of 0.2 mm and were reported to comprise of 99.4% sand (Fugro, 2006).

Total hydrocarbon concentrations (THC) across the 2006 Varg pipeline survey site ranged from 3.1 $\mu g.g^{-1}$ to 10.5 $\mu g.g^{-1}$. In general levels of hydrocarbon were considered to be elevated for the sediment type notably at stations 1, 5 and 6. In 2006 THC was found to be greater than the mean THC found in comparative surveys conducted in UKCS Blocks 22/5b and 16/29, however in the context of NSTF (1993) and UKOOA (2001) the concentrations were considered normal and representative of background (Gardline, 2007b). The 2012 regional surveys of the Sleipner area (which incorporates the Rev field and the area which comprises the Rev UKCS Decommissioning Project) showed THC to be reduced from levels recorded in 2009 and no values were higher than Limits of Significant Contamination (LSC) (DNV, 2013).

The majority of heavy metals showed only small variations across stations (Fugro, 2006, Gardline, 2007 & DNV, 2013). However levels of barium showed a large range and were generally elevated. During the 2006 surveys barium concentration ranged from 101 $\mu g.g^{-1}$to 329 $\mu g.g^{-1}$ (station 5). The high levels at station 5 is substantially higher than levels at other stations and indicative of petrogenic contamination, this is supported by elevated levels of hydrocarbons at this station. The 2007 Rev pipeline survey reported barium levels of 250 $\mu g.g^{-1}$to 310 $\mu g.g^{-1}$, these concentrations are not above UKOOA (2001) background levels and indicate the barium did not contain barite rich drill cuttings (Gardline, 2007b). All stations sampled in the Rev field area in the 2012 regional surveys showed barium concentrations higher than LSC. However no discharges of barium were reported in the three year period prior to the previous surveys (DNV, 2013).

Figure 5-3 Bathymetry and survey stations from the Rev proposed pipeline route geophysical survey (Gardline, 2007a)

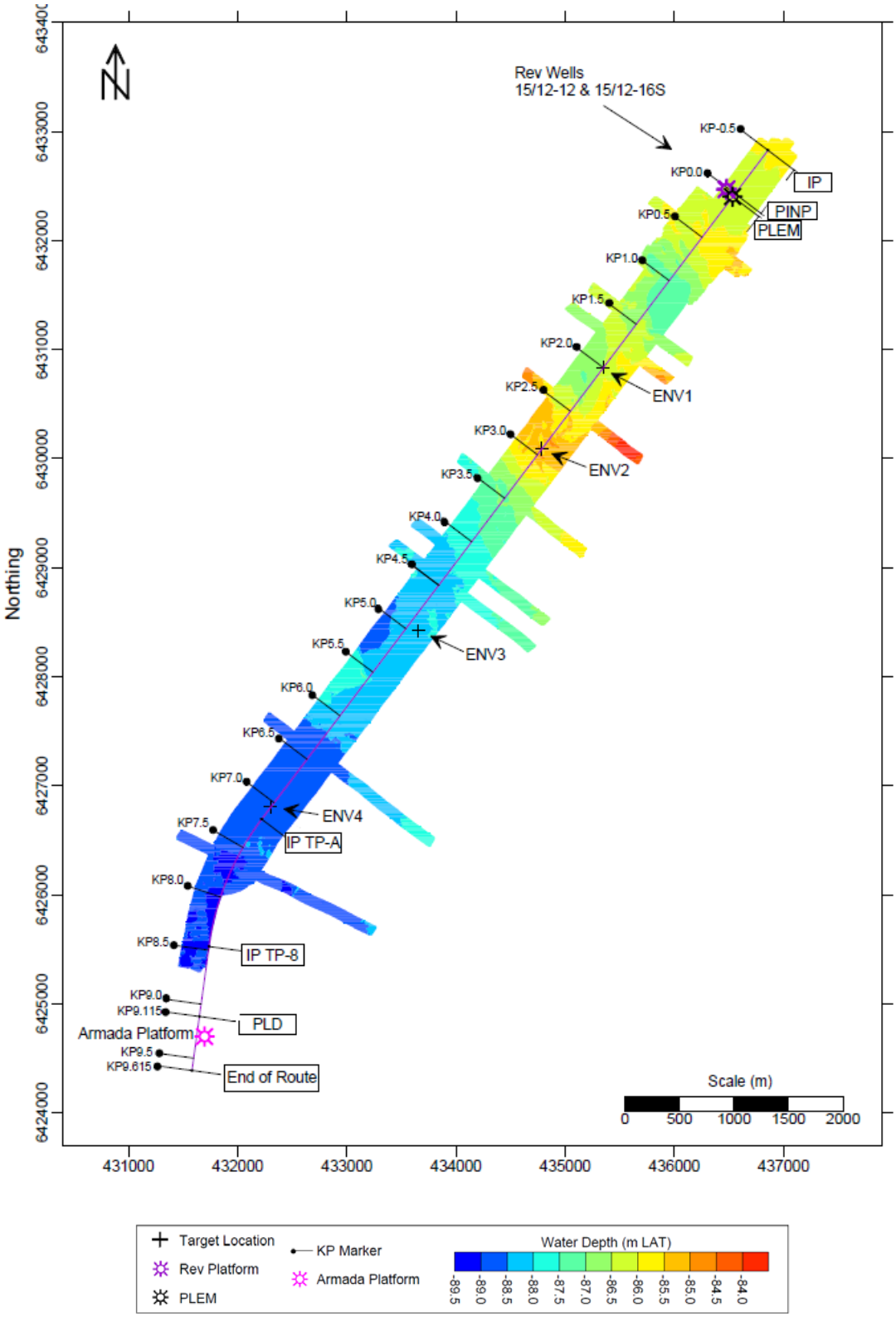


Figure 5-4 Seabed sediments at the Rev UKCS Decommissioning Project location

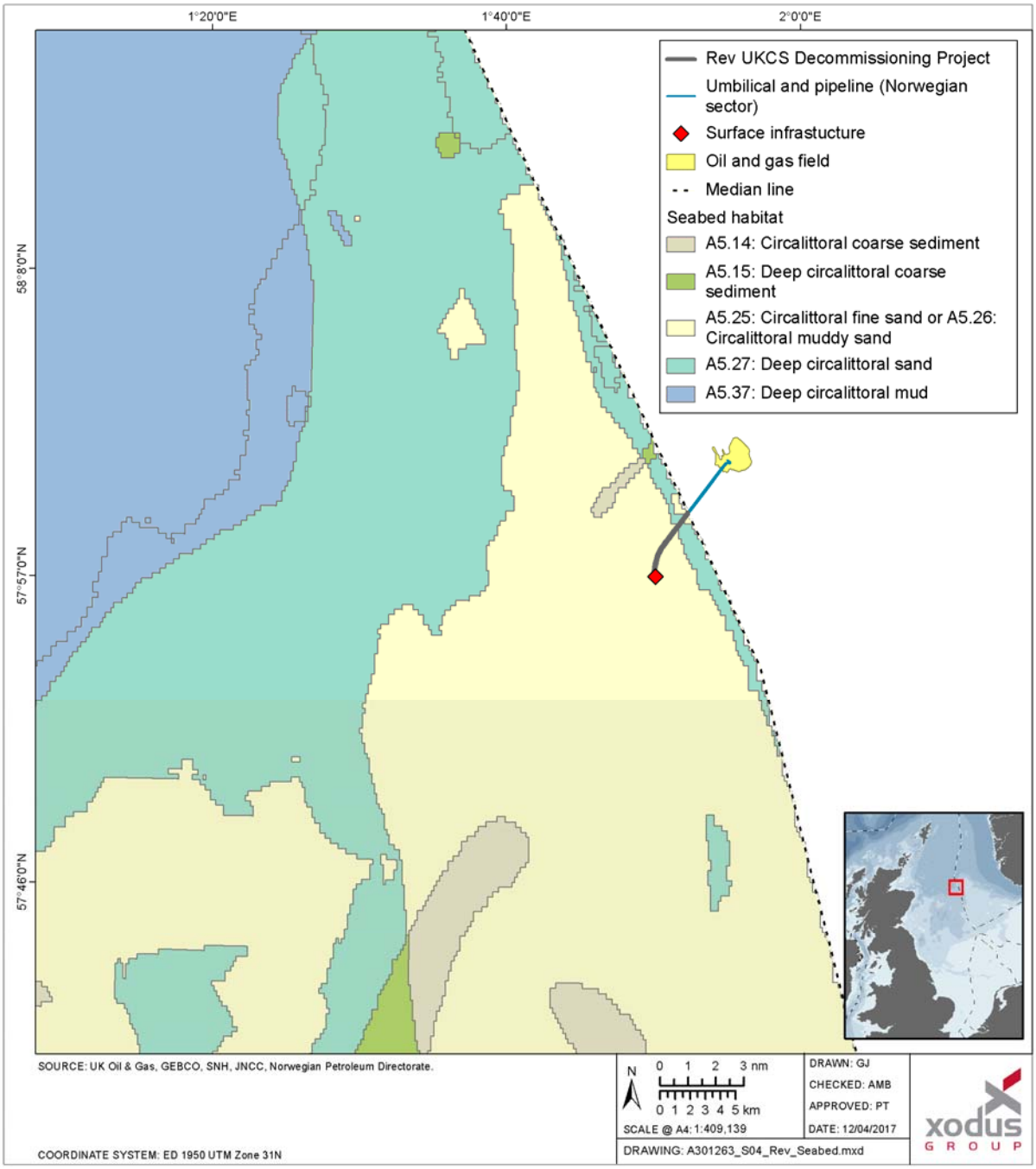
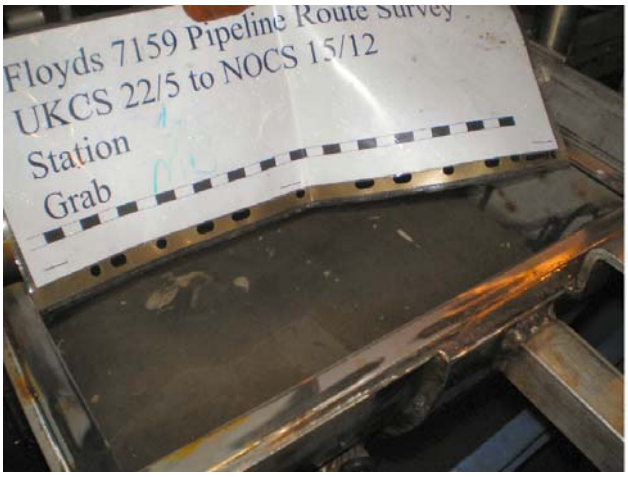


Figure 5-5 Sediment examples from grab samples taken in the 2007 Rev proposed pipeline route survey (Gardline, 2007a)

	Sediment sample from station ENV 4 Depth: 89 m Grey clay silty sand. Smell of hydrocarbons
	Sediment sample from station ENV 4 Depth: 89 m Grey brown silty sand

5.5 Biological Environment

5.5.1 Plankton

Plankton consists of the plants (phytoplankton) and animals (zooplankton) that drift in the surface waters with the tides and currents. Plankton forms the basis of marine ecosystem food webs and the composition of planktonic communities is variable temporally, depending upon the circulation patterns of water masses, the season and nutrient availability. The distribution and abundance of plankton is heavily influenced by water depth, tidal mixing and thermal stratification within the water column (Edwards *et al*., 2010). The majority of the plankton occurs in the photic zone (the upper 20 m or so of the sea) which receives enough light for photosynthesis (Johns and Reid, 2001). However, zooplankton distribution can extend to greater depths and many species undergo diurnal vertical migrations, rising to the surface to feed before returning to depth. Natural seasonality and high small-scale variability, both in species composition and abundance, is an important feature of planktonic communities. Many species of larger animals such as fish, birds and cetaceans, are dependent upon the plankton for food.

The distribution of plankton therefore directly influences the movement and distribution of other marine species.

The composition of planktonic communities that form the basis of marine ecosystem food webs is seasonal. Phytoplankton abundance and productivity is driven by sunlight intensity and nutrient availability, which ultimately depends on mixing and thermal stratification in the water column (Johns and Reid, 2001, Edwards *et al*., 2010). In the 10-year period between 1997 and 2007, central North Sea phytoplankton levels peaked in April with a second, smaller peak in August. Abundance and productivity decrease through the winter months when light and temperature conditions are less favourable (SAHFOS, 2015).

The dinoflagellate genus *Ceratium* dominates the phytoplankton community in the central North Sea (DECC, 2016). The most abundant zooplankton species in the North Sea are the calanoid copepods, in particular *Calanus* spp. and smaller copepod species such as *Para-Pseudocalanus* spp. and *Acartia* (Johns and Reid, 2001). Historically *Calanus finmarchicus* dominated the North Sea zooplankton, however, its abundance and biomass has declined significantly over the last 60 years, while populations of *C. helgolandicus* and other boreal and temperate Atlantic and neritic species have increased (DECC, 2016, Baxter *et al*., 2011, Edwards *et al*., 2013). This has been attributed to changes in seawater temperature and salinity (Beare *et al*., 2002, FRS, 2004). In Continuous Plankton Recorder data, these changes are increasingly evident on a gradient from north to south through the North Sea.

5.5.2 Benthos

Knowledge of the composition of the infauna (invertebrates living within benthic sediments) and epifauna (mobile or sessile species living on the seabed) is important in predicting the potential impacts of the disturbance that could result from the proposed operations.

The 2007 Rev pipeline survey recovered 531 individuals from 74 taxa from eight grab samples at four survey stations. Polychaete annelids (bristle worms) dominated the fauna recorded accounting for 61% of the recorded individuals and 46% of the taxa. Species included *Myriochele sp*., *Spiophanes bombyx* and *Paramphinome jeffreysii*. Crustacean taxa accounted for 11% of the individuals and 16 % of the taxa and mollusc taxa accounted for 12 5 of the individuals and 24 % of the taxa and echinoderm taxa accounted for 11 % of individuals and 7 % of taxa (Gardline, 2007b). The number of taxa recorded was described as uniform across stations ENV1, ENV3 and ENV4 but noticeably lower at ENV2, this was attributed to differences in substrate and the dominance of coarse matter at ENV2. The taxa recorded are considered characteristic of sandy substrates in the CNS (Rees *et al*., 2007).

The most abundant species the annelid polychaete *Myriochele* sp., as most commonly been recorded in the northern North Sea, but abundance has been recorded as increasing in the central North Sea (Rees *et al*., 2007).

The 2012 regional surveys reported that the fauna was relatively uniform across the four survey stations and that the diversity indices of benthic fauna were somewhat lower than regional surveys in 2009 but higher than regional survey results in 2006. These differences are attributed to natural temporal variation and there was no indication of disturbance to the benthic community (DNV, 2012).

None of the surveys mentioned recorded the presence of any Annex I habitats within their survey areas (Gardline, 2007b, DNV, 2012 and Fugro 2006).

5.5.3 Fish and Shellfish

DECC (2016) report that species diversity within the fish community is not as great in the central and northern North Sea as in the southern North Sea. DECC (2016) also report that the fish community between 100 and 200 m (i.e. within the depth bounds of the Project area) is characterised by long rough dab (*Hippoglossoides platessoides*), hagfish (*Myxine glutinosa*) and Norway pout (*Trisopterus esmarkii*). Basking shark (*Cetorhinus maximus*), tope (*Galeorhinus galeus*) and porbeagle (*Lamna nasus*) are all also likely to occur in small numbers throughout the North Sea, and the common skate (*Dipturus batis*) occurs at low density throughout the northern North Sea. However, these species are considered to be rare in the waters surrounding the Project area (DECC, 2016).

Fisheries sensitivity data (Coull *et al*., 1998, Ellis *et al*., 2012) have been used to identify the spawning grounds (location where eggs are laid) and nursery grounds (location where juveniles are common) for

fish species in the vicinity of the Project area (Figure 5-6). The 2007 Rev pipeline survey concluded that the seabed in the area offered very little or no herring spawning potential due to the predominance of silty sand and the absence of their preferred gravel substrate (Gardline, 2007a).

The Project area supports spawning and nursery habitats for a number of commercially species (Coull *et al*., 1998, Ellis *et al*., 2012; Figure 5-6)

Figure 5-6 Spawning and nursery grounds within the Project area (Coull *et al*., 1998, Ellis *et al*., 2012)

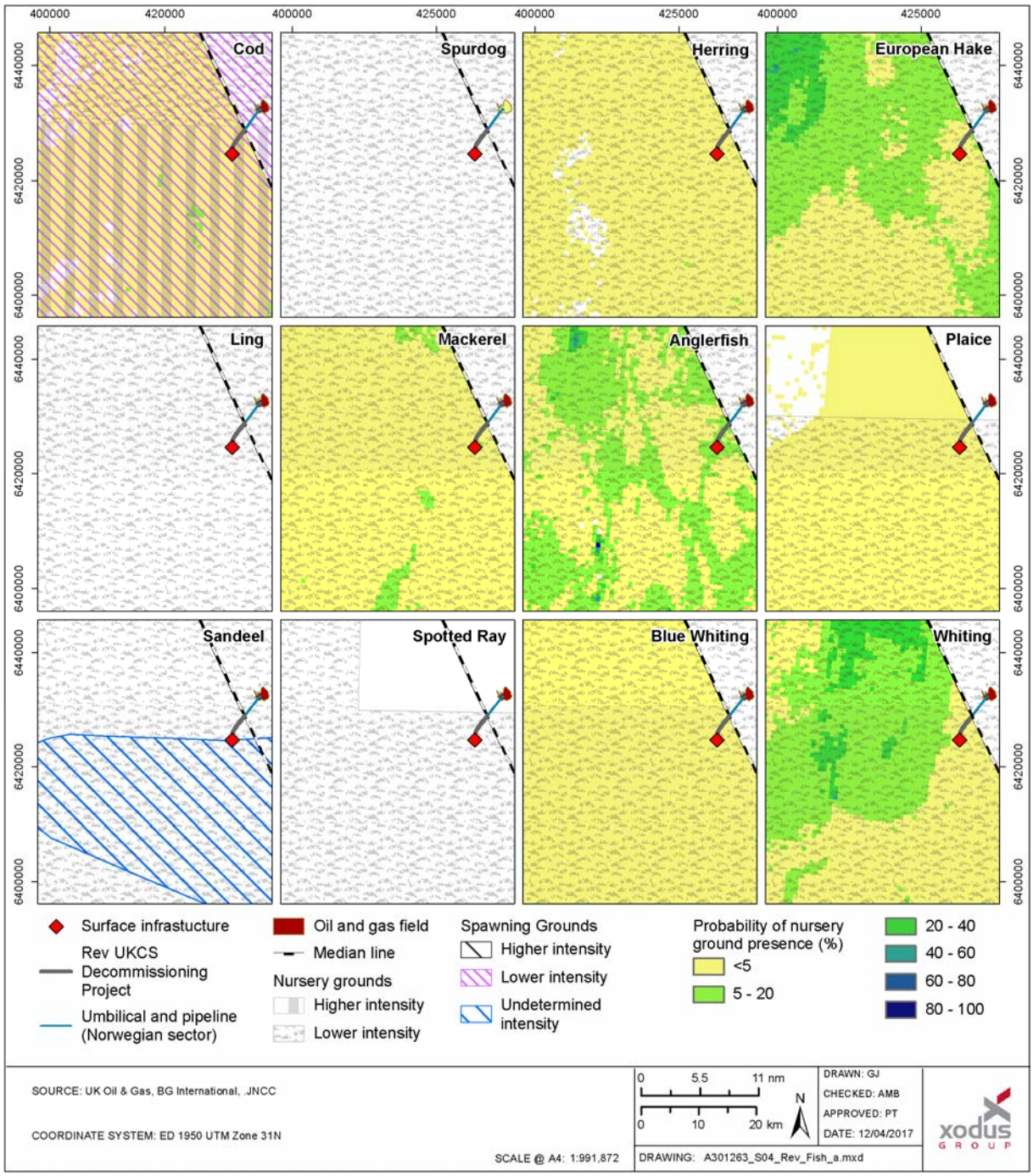
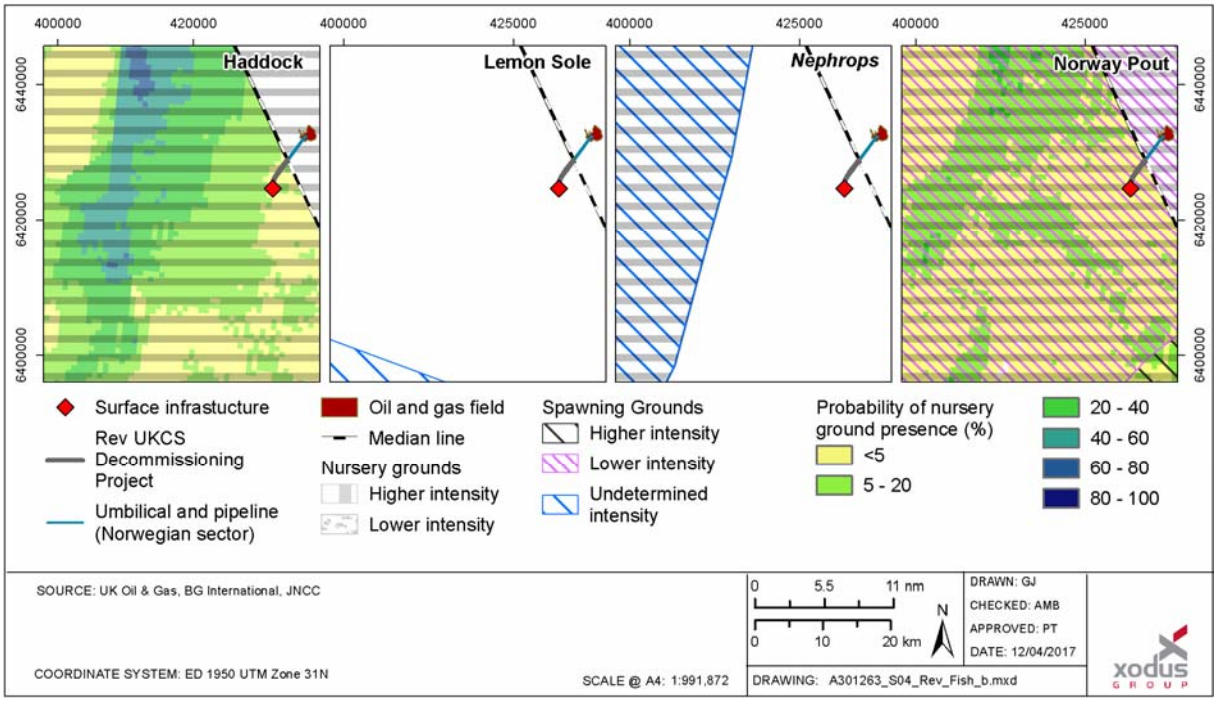


Figure 5-6 Spawning and nursery grounds within the Project area (Coull *et al*., 1998, Ellis *et al*., 2012) continued



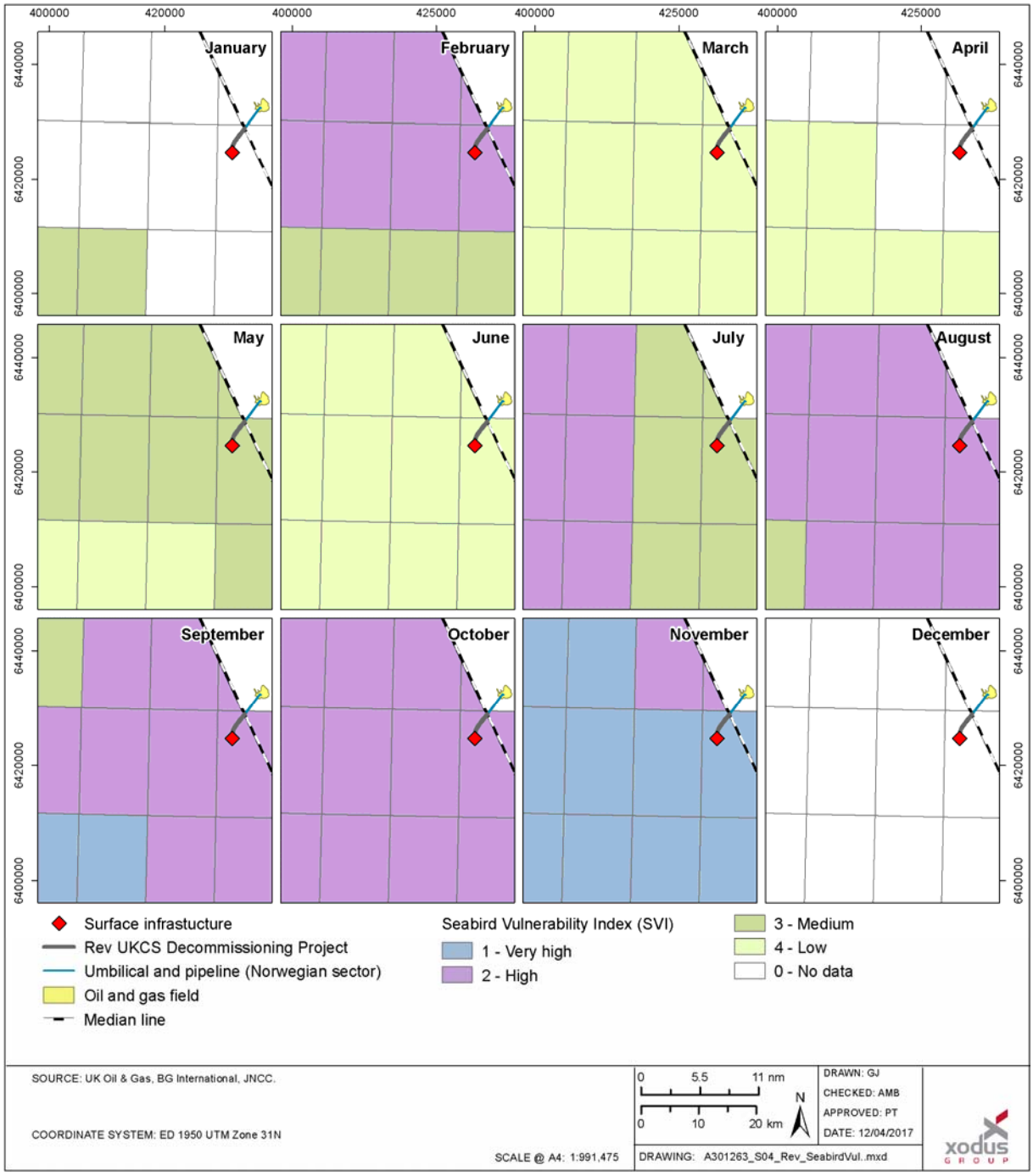
5.5.4 Seabirds

Much of the coastline and offshore waters of the North Sea are internationally important breeding and feeding habitats for seabirds. The most numerous species likely to be present in the Rev area are northern fulmar (*Fulmarus glacialis*), black-legged kittiwake (*Rissa tridactyla*) and common guillemot (*Uria aalge*) (DECC, 2016). JNCC (2016a) report the population change between 1998 – 2002 and 2015 for these species as -31% for northern fulmar, -44% for black-legged kittiwake and +5% for common guillemot. JNCC (2016a) considers the reduction in the quantity of offal discharged from the North Sea whitefish industry fleet to have contributed to the decline in breeding numbers of northern fulmar and black-legged kittiwake. Black-legged kittiwake and common guillemot populations have been closely linked to variations in the sand eel abundance (JNCC, 2016).

Published in 1999, JNCC (1999) compiled the 'offshore vulnerability index' from surveys to assess the distribution and abundance of seabird populations onshore and offshore and to assess the possible threat of surface pollution to them. Although there have been changes in seabird distribution and abundance since then (as evidenced in the above paragraph), these data give a broad indication of the likely relative importance of an area over the year. Figure 5-7 presents the vulnerability of seabirds in the Project area. The highest seabird vulnerability occurs later in the year, when birds (some of which will be flightless whilst they change plumage) have moved offshore following breeding.

It is recognised that JNCC has released further data on vulnerability, as reported by Hi Def (2016). For the Project area, review of these data indicate vulnerability of similar or lower magnitude. However, there are significant data gaps at certain times of the year, and this assessment has retained the higher sensitivity ratings (i.e. JNCC, 1999) to ensure sensitivity is not underestimated.

Figure 5-7 Seasonal seabird vulnerability to surface oil pollution (JNCC, 1999) in the vicinity of the Rev UCKS Decommissioning Project



5.5.5 Marine mammals

Of the 19 cetacean species recorded in UK waters (Reid *et al*., 2003), the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*) and white-beaked dolphin (*Lagenorhynchus albirostris*) are most regularly recorded in the North Sea (NMPI, 2016, Reid *et al*., 2003).

The species most likely to be encountered in the Rev area are harbour porpoise, white-beaked dolphin and minke whale. In the central North Sea, SCANS-II survey estimated densities of 0.294 harbour porpoise animals per km^2, 0.049 white-beaked dolphins per km^2, 0.040 white-sided dolphin per km^2, 0.028 minke whales per km^2 and 0.001 bottlenose dolphins per km^2 (JNCC, 2010a).

Spatially and temporally, harbour porpoises, white-beaked dolphins, minke whales, killer whales and white-sided dolphins are the most regularly sighted cetacean species in the North Sea (Hammond *et al*., 2001; Reid *et al*., 2003). The bottlenose dolphin is generally coastal in extent and thus is unlikely to be sighted in the vicinity of the Project area with any regularity. Occurrence of the most frequently recorded species is detailed in Table 5.2.

Table 5.2 Occurrence of cetaceans likely to be most regularly observed in the Project area (Hammond *et al*., 2001, Reid *et al*., 2003)

Species	Description of occurrence
Harbour porpoise	Harbour porpoise are frequently found throughout the UK waters. They usually occur in groups of one to three individuals in shallow waters, although they have been sighted in larger groups and in deep water. It is not thought that the species migrate.
Killer whale	Widely distributed with sightings across the North Sea all year round; seen in both inshore waters (April to October) and the deeper continental shelf waters (November to March). May move inshore to target seals seasonally.
Minke whale	Minke whales usually occur in water depths of 200 m or less and occur throughout the northern and central North Sea. They are usually sighted in pairs or in solitude; however groups of up to 15 individuals can be sighted feeding. It appears that animals return to the same seasonal feeding grounds.
Atlantic white-sided dolphin	White-sided dolphin show both season and inter-annual variability. They have been sighted in large groups of 10 - 100 individuals. They have been sighted in waters ranging from 100 m to very deep waters, but also enter the continental shelf waters. They can be sighted in the deep waters around the north of Scotland throughout the year and enter the North Sea in search of food.
White-beaked dolphin	White-beaked dolphin are usually found in water depths of between 50 and 100 m in groups of around 10 individuals, although large groups of up to 500 animals have been seen. They are present in the UK waters throughout the year, however more sightings have been made between June and October.

5.5.5.1 Seals

Grey (*Halichoerus grypus*) and harbour (*Phoca vitulina*) seals will feed both in inshore and offshore waters depending on the distribution of their prey, which changes both seasonally and yearly. Both species tend to be concentrated close to shore, particularly during the pupping and moulting season.

The harbour seal (*Phoca vitulina*) is widespread along the coastline of eastern Scotland. Seal tracking studies from the Moray Firth indicate that harbour seals forage within 40 – 50 km of their haul-out sites (SCOS, 2013), so harbour seals are unlikely to be observed in the Rev decommissioning project area.

The population of grey seal (*Halichoerus grypus*) tends to be concentrated close to shore, particularly during the pupping and moulting season, but the grey seal is known to make occasional trips of several hundred kilometres from one haul-out to another (SMRU, 2011). Jones *et al*., (2013) mapped a grey seal density of 0 – 1 seals per 25 km^2 around the Rev area. It is possible, but unlikely, that grey seals will be encountered in the Rev decommissioning project area.

In summary, as the Rev UKCS Decommissioning Project is located approximately 221 km offshore, these species may be encountered in the vicinity from time to time, but are unlikely to use the area with any regularity or in great numbers.

5.6 Conservation

A number of sites and species of conservation importance occur in the vicinity of the Rev UKCS Decommissioning Project. Designated sites are shown below in Figure 5-8.

5.6.1 Special Areas of Conservation

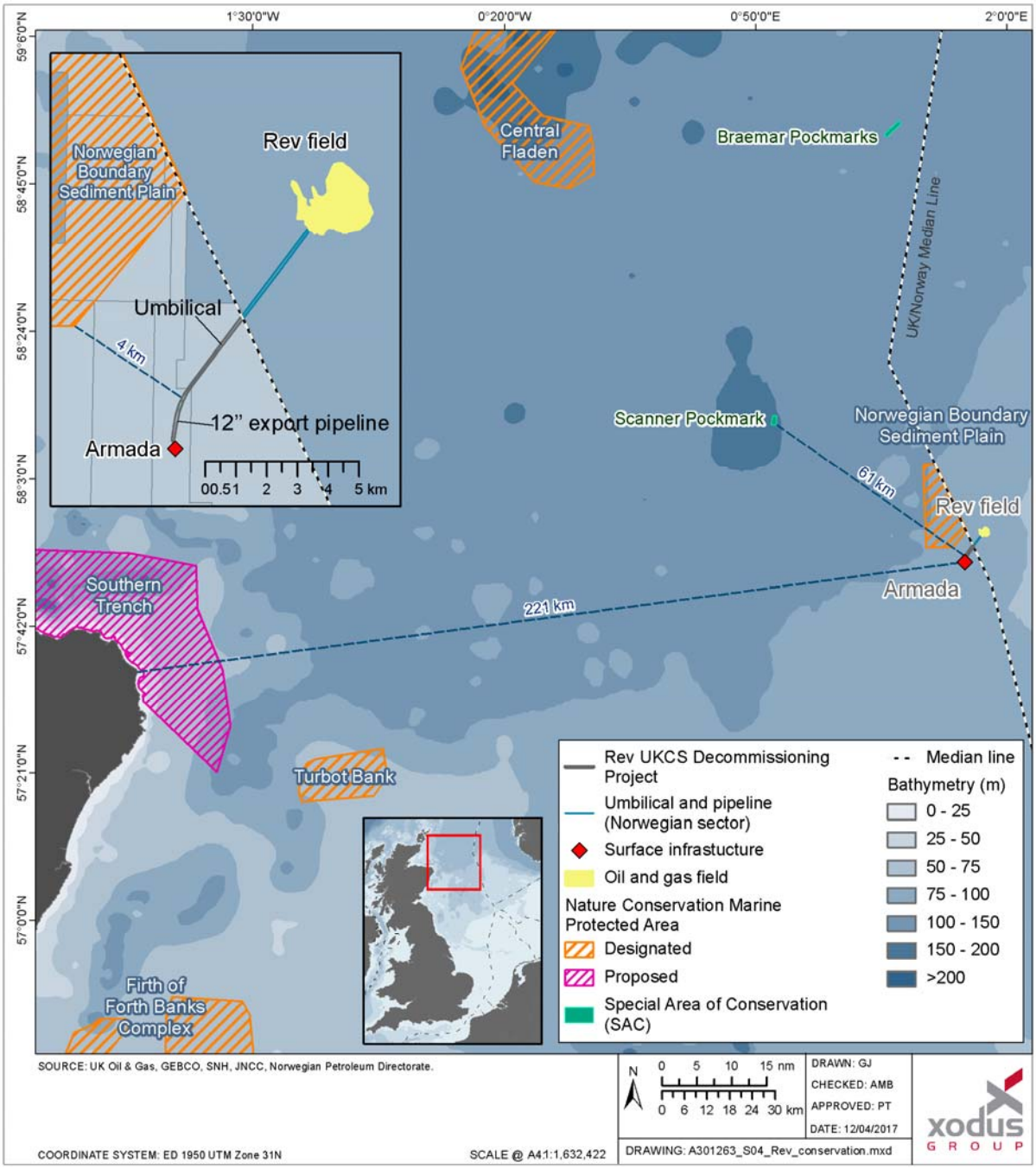
The UK has designated 'Special Areas of Conservation' (SACs) to protect important examples of the habitats listed in Annex I of the European Union (EU) Habitats Directive (92/409/EEC). The closest SAC to the Project area is the Scanner Pockmarks SAC located approximately 61 km to the northeast (Figure 5-8). The SAC was designated to conserve the biodiversity associated with submarine structures made by leaking gases (JNCC, 2016b).

5.6.2 Marine Protected Areas

Marine Scotland has put forward areas with Priority Marine Features (PMF) for designation as Nature Conservation Marine Protected Areas (NCMPAs) under the Marine (Scotland) Act (2010). The Marine Management Organisation (MMO) has put forward areas with features of conservation importance (FOCI) for designation as Marine Conservation Zones (MCZs) under the UK Marine and Coastal Access Act (2009).

In 2014, the Norwegian Boundary Sediment Plain NCMPA was designated for the conservation of aggregations of the ocean quahog (*Arctica islandica*) and the sand and gravel habitat that supports them. The site is located approximately 4.5 km north west from the Project area (Figure 5-8).

Figure 5-8 Conservation designations in the vicinity of the Rev UCKS Decommissioning Project



5.6.3 Species

Annex II species are protected under the EU Habitats Directive. This forces core areas of habitat these species rely upon to be protected under the Natura 2000 Network. The only species listed on Annex II of the EC Habitats Directive that is likely to occur in the vicinity of the Project area with any regularity is the harbour porpoise. The harbour porpoise is the most common cetacean in UK waters, being widely distributed and abundant throughout the majority of UK shelf seas, both inshore and offshore. Due to the species' wide geographical distribution and the lack of knowledge with regards to their feeding and breeding habitats, there has been difficulty in selecting sites essential for their life and reproduction, as required under the Habitats Directive. Although potential calving grounds have been identified in the German North Sea (Sonntag *et al*., 1999) no such areas are currently recognised in UK waters. However, a number of sites have been designated as possible or candidate SACs; none of these sites are located within the central North Sea (Figure 5-8). Grey and harbour seals are also Annex II species but due to the distance from shore they are unlikely to be present in any significant numbers in the area.

European Protected Species (EPS) are a group of animals and plants protected by law throughout the EU listed in Annexes II and IV of the Habitats Directive 92/43/EEC. Cetaceans are the EPS most likely to be recorded in the region, even if only in low numbers. The European sturgeon *Acipenser sturio* and leatherback turtle are also classed as EPS and occur in UK waters, although the Project area is located at the furthest extent of their ranges and their occurrence in any numbers is unlikely.

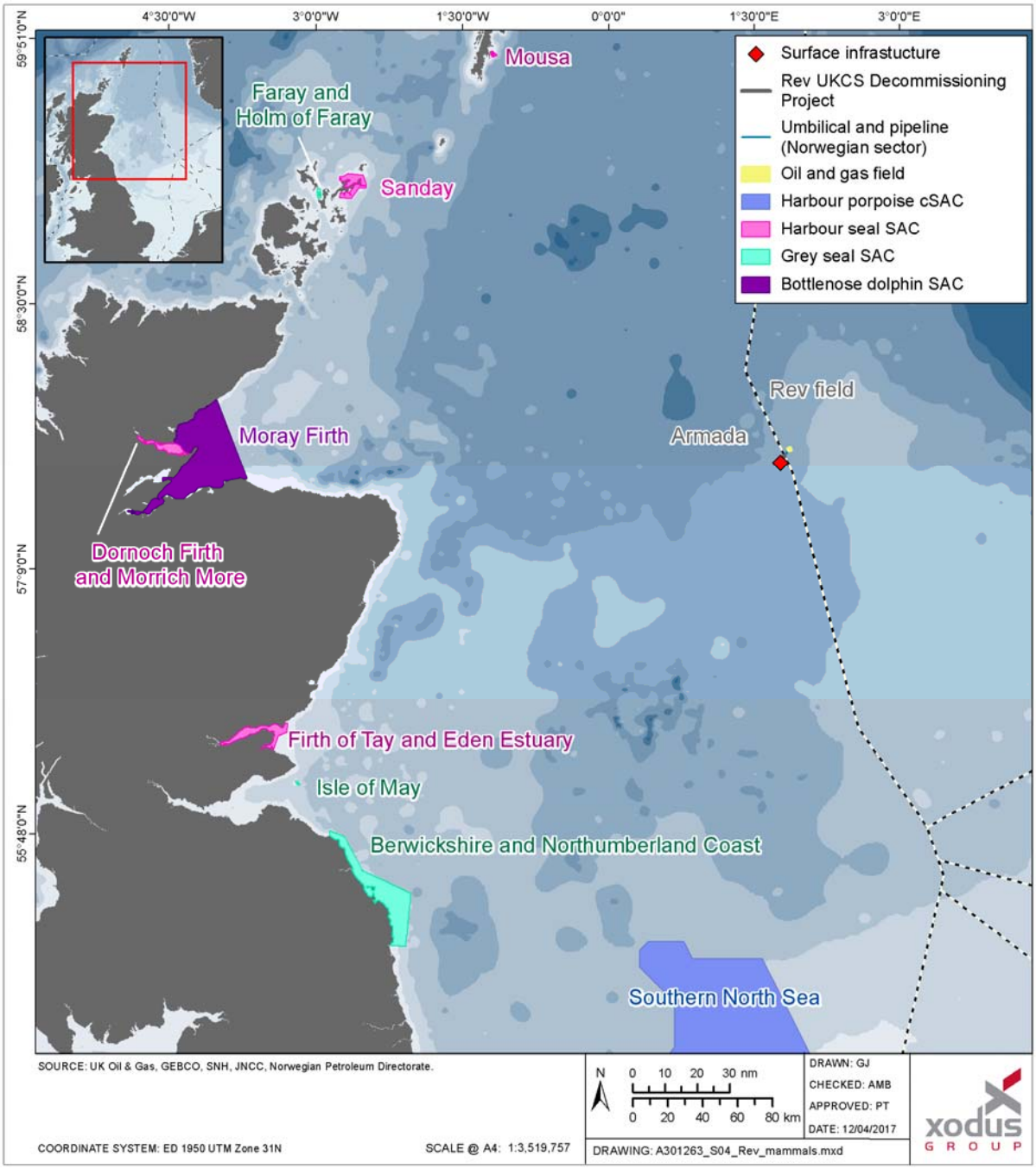
Some species listed by OSPAR as 'threatened and/or declining species' are likely to be present in the Project area, including the black-legged kittiwake and cod (OSPAR, 2008). Species listed as Scottish PMFs including commercial fish species, non-commercial fish species and sharks (in particular basking sharks) are also likely to be present in the Project area (SNH, 2014).

The wider Rev area may support 'seapen and burrowing megafauna communities', which are a Scottish PMF and are listed by OSPAR List as 'threatened and or declining species and habitats' (OSPAR, 2008). However, although surveys in the area have observed seapens, the 'seapen and burrowing megafauna communities' classification was not assigned to any habitat identified during the survey (Fugro, 2007).

None of the survey work undertaken in the Project area identified the presence of ocean quahog but its presence is possible. The species is a qualifying feature of the nearby Norwegian Boundary Sediment Plain NCMPA and features on the OSPAR list of threatened and/or declining species (OSPAR, 2008) as well as being a Scottish PMF (SNH & JNCC, 2014).

Basking sharks, spiny dogfish and blue sharks are the species listed on the IUCN red list most likely to be encountered in the vicinity of the Project area. The basking shark and spiny dogfish are classed as vulnerable under the IUCN red list. The blue shark is classed as near threatened. In addition, basking sharks are protected under the Wildlife and Countryside Act 1981 (as amended).

Figure 5-9 Protected sites for marine mammals



5.7 Socio-Economic Environment

The key socio-economic features in the Project area:

- Oil and gas activities;
- Commercial fishing; and
- Commercial shipping.

None of the following activities, operations or features occur in the vicinity of the Project area:

- Existing or planned renewable energy developments;
- Protected wrecks or Historic Marine Protected Areas (NMPi, 2017 Historic Environment Scotland, 2016);
- Aggregate extraction areas; and
- Military Practice or Exercise Areas areas (DECC, 2016).

5.7.1 Commercial fisheries

5.7.1.1 Fishery type and important species

The North Sea has important fishing grounds fished by the fishing fleets of the UK and other nations, targeting demersal, pelagic, and shellfish species. The Project area is located in in ICES rectangle 44F1. According to Scottish Government statistics for 2011 to 2015, ICES rectangle 44F1 is targeted for demersal, pelagic and to a lesser extent shellfish species (Table 5.3) (Scottish Government, 2016).

For ICES rectangle 44F1, demersal landings comprised 57% of the value in the time period from 2011 to 2015 and was the most valuable species group landed in each of the five years (Table 5.3). Shellfish and pelagic species contribute almost equally to the total value in the period from 2011 to 2015 with each making an approximately 20% contribution. Pelagic species were the most landed species by weight, accounting for 60% of the total landing tonnage in the time period from 2011 to 2015. However when each year examined individually, pelagic species is were only the most landed species group by weight in 2013. This unusually high tonnage is the major contributor to the tonnage total for the five year period (Table 5.3).

From 2012 to 2013 there is a significant increase in the value and Liveweight of all landings. In 2013, 2014 and 2015 this figure has remained relatively constant.

Haddock and Nephrops are the most valuable species landed in each year from 2011 to 2015 apart from 2013. For 2011, 2012, 2014 and 2015 haddock accounted for 39% of the landings value. In 2013 haddock accounted for 28% of the landings value. In 2013 the most valuable species was herring which accounted for 58% of the landings value. This large herring catch in 2013 does not appear to be a trend as herring is not a significant contributor to landings weight or value in any of the other years examined (Scottish Government, 2016).

5.7.1.2 Fishing effort

The monthly effort figures are presented in Table 5.4. The general trend for fishing effort between 2011 and 2015 is for the first half of the year (January to June) to be quieter as indicated by the frequency of disclosive data for these months. The latter half of the year shows greater effort levels in terms of days fished with September and November showing the greatest effort levels. The greatest level of fishing effort for any of the years from 2011 to 2015 was shown in 2015 with a total of 253 days effort.

Trawls were the most utilised gear type in ICES rectangle 44F1 from 2011 to 2015. Seine nets are used but the data available for this gear is disclosive indicating a low level of use (Scottish Government, 2016)

Overall, fishing effort in the Project area is considered low compared with other areas of the North Sea (Kafas *et al*., 2012).

Table 5.3 Live weight (t) and value (£) for landings in ICES rectangle 44F1 from 2011 to 2015 (Scottish Government, 2016)

Year	Species type	Live weight (tonnes)	Value (£)
2015	Demersal	739	962,021
	Pelagic	201	65,103
	Shellfish	63	240,844
2014	Demersal	717	1,025,211
	Pelagic	403	141,130
	Shellfish	84	346,050
2013	Demersal	497	614,513
	Pelagic	3,315	977,956
	Shellfish	20	79,610
2012	Demersal	198	201,855
	Pelagic	0.41	716
	Shellfish	19.65	69,571
2011	Demersal	352	480,384
	Pelagic	268	73,683
	Shellfish	113	460,453

Table 5.4 Number of days fished per month (all gears) in ICES rectangle 44F1 from 2011 to 2015 (Scottish Government, 2016)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total[2]
2015	6	66	DD	ND	DD	9	6	34	24	34	52	20	253
2014	DD	DD	DD	DD	DD	DD	11	56	49	12	70	10	233
2013	DD	DD	ND	12	16	DD	19	25	10	19	14	11	133
2012	DD	DD	ND	DD	DD	DD	DD	DD	6	DD	12	7	64
2011	ND	3	17	13	1	16	8	66	49	44	29	2	246

Note: Monthly fishing effort by UK vessels: green = 0 – 100 days fished, yellow = 101 – 200, orange =201-300, red = ≥301. ND = no data. DD = Disclosive data (Scottish Government, 2016).

5.7.2 Oil and gas activities

The central North Sea has extensive mature oil and gas developments (UKOilAndGasData, 2017). There are a number of production facilities and a network of subsea flowlines, export pipelines and cables on the seabed in the wider area (Figure 5-10).

2 Table total includes disclosive data thus does not match the total of the numbers in the table alone.

5.7.3 Shipping activity

Although, the North Sea has substantial traffic of commercial ships trading between North Sea and Baltic ports, the density of shipping in the Rev UCKS Decommissioning Project is low, with approximately 0.2 – 0.5 vessels passing each week with the majority of traffic consisting cargo vessels (DECC, 2016). Other vessels that pass within the vicinity of the Project area include dredging or underwater operation vessels and fishing vessels.

Figure 5-10 Oil and gas infrastructure in the vicinity of the Rev UKCS Decommissioning Project

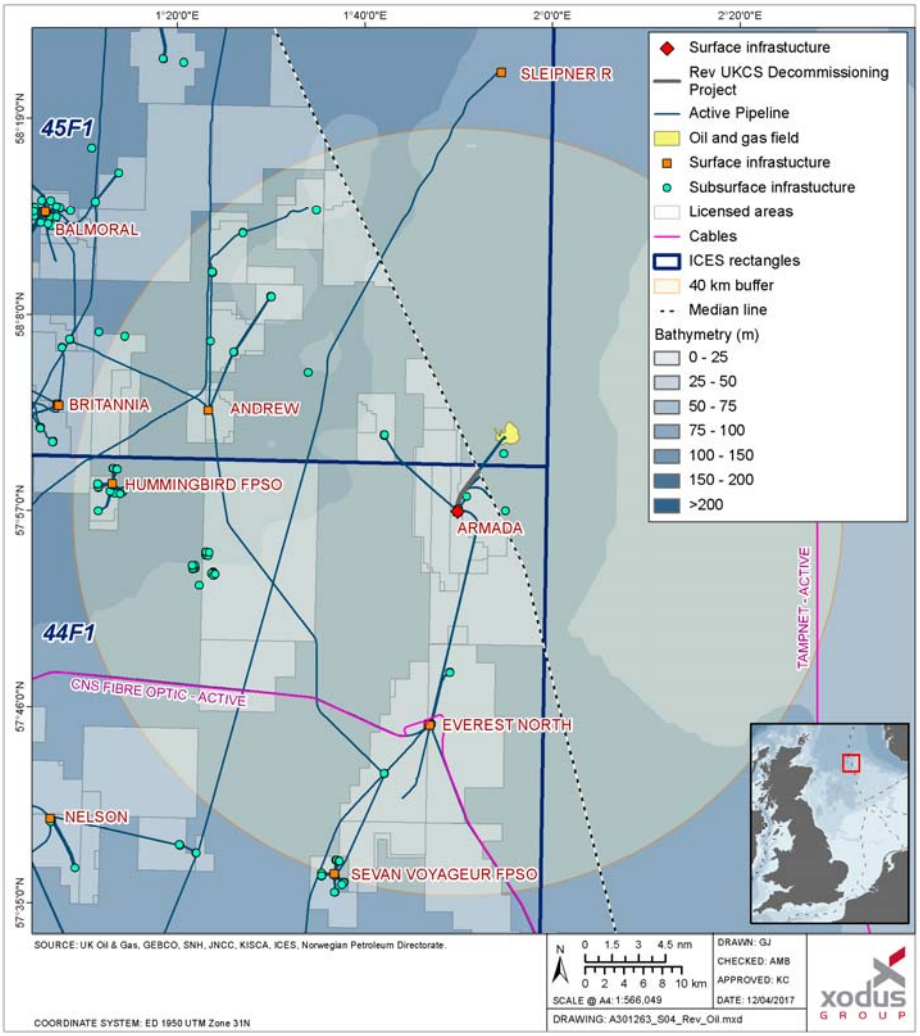


Table 5.5 Oil and gas infrastructure within 40 km of the Rev UKCS Decommissioning Project

Infrastructure	Operator	Distance and direction
Armada platform	Chrysaor	-
Andrew platform	BP	27.5 km northwest
Everest North riser	BG Group	22.5 km south
Hummingbird FPSO	Wood Group	36 km west

Infrastructure	Operator	Distance and direction
Sevan Voyageur FPSO	EON	40 km southwest
Varg	Repsol	6 km northeast

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6 IDENTIFICATION OF POTENTIAL ENVIRONMENTAL IMPACTS

6.1 Introduction

This section describes the approach to the assessment of potential environmental impacts in line with the expectations set out in the BEIS Guidance Notes for Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998.

The EIA process requires an understanding of the proposed decommissioning activities and the environment upon which there may be an impact. Fundamental to the process is the systematic identification of issues that could impact the environment, including other users of the environment. Once identified these issues have to be assessed to define the level of potential impact they present to the environment, so that if necessary measures can be taken to remove or reduce such effects through mitigation. This process also identifies aspects of the proposed decommissioning activities that may require monitoring.

6.2 Environmental Issues Identification

Having defined the project (section 3) and defined the baseline environment including the sensitivity of receptors (section 5) it is then necessary to identify and assess the possible effects. Identification of the activities and potential impact pathways associated with the proposed decommissioning project has been undertaken and is summarised in Table 6.1.

Table 6.1 Issues to be considered as part of the EIA

Potential Impact	Considered in the EIA	Where applicable what has not been assessed
Energy use and atmospheric emissions	Vessel use, material use, material recycling, material replacement, transport of materials. section 7	Use of raw materials, such as rock and seawater, as neither are considered scarce resources.
Discharges to sea	Discharge of residual hydrocarbon during decommisioning of the pipeline and through degredation of the pipeline left *in situ*. Discharge of reidual chemical from decommissisioning of the umbilical. section 8	Discharges associated with flushing and cleaning of the pipeline and umbilical, as these are captured as part of the ongoing operation of the assets.
Other sea users	Use of space, both short and long-term, including potential for snagging of fishing gear. section 0	-
Underwater noise	Vessel and cutting noise on marine mammals and fish. section 10	-

Potential Impact	Considered in the EIA	Where applicable what has not been assessed
Physical presence – seabed disturbance	Interaction with the seabed through direct impacts and indirect impacts as a result of infrastructure removal, placing of new matreial and post decommissioning overtrawl surveys. section 11	Disturbance as a result of ROV operations as the sediment disturbance is anticiapted to be minimal.
Accidental events	Collision risk between vessels, accidental release of inventory offshore or onshore. section 12	Loss of inventory from pipeline and umbilical as flushing and cleaning will have occurred prior to decommissioning and is not part of this EIA scope.
Waste management	Information on onshore dismantling and managament of waste. section 13	-

As agreed with BEIS this EIA is designed to supplement the EIA already submitted to Norwegian authorities for the Rev field. It therefore only assesses the decommissioning activities that specifically relate to the Rev infrastructure in the UKCS. The decommissioning activities associated with the Norwegian sector of the North Sea are considered in this EIA from a cumulative and in-combination perspective only.

The subsequent sections of this ES have been used to justify (where required) where no impacts are expected and assess the significance of any potential impacts. Where appropriate they highlight the management, mitigation and monitoring measures that will be in place to mitigate and / or manage specific impacts.

6.3 Impact Significance

6.3.1 Overview

The decision process related to defining whether or not a project may significantly impact on the environment is the core principle of the EIA process; the methods used for identifying and assessing potential impacts should be transparent and verifiable.

The method presented here has been developed by reference to the principles and guidance provided by the Institute of Ecology and Environmental Management (IEEM) guidelines for marine impact assessment (IEEM, 2010), the Marine Life Information Network (MarLIN) species and ecosystem sensitivities guidelines (Tyler-Walters et al, 2001), guidance provided by SNH in its handbook on EIA (SNH, 2013) and the equator principles for determining, assessing and managing social and environmental risk in project financing (http://www.equator-principles.com/). This established method has been used previously for the assessment of impacts associated with oil and gas projects on the UKCS.

Despite the determination of impact significance being a subjective process, a defined methodology is used to make the assessment as objective and auditable as possible. The significance of any potential impact is determined through the use of a risk assessment approach which employs the standard philosophy of:

Magnitude of potential impact (consequence) x Likelihood of occurrence (frequency/probability) = Risk

The following sections describe the criteria that have been used to assess the significance of potential impacts identified in Table 4.1 and discussed in the subsequent sections of the ES.

6.3.2 Consequence of potential impact

Consequence of a potential impact (Table 6.2) involves the consideration of three drivers:

- **Potential environmental impact (E)** - consideration of potential environmental sensitivities and scientific evidence on potential environmental impacts;
- **Stakeholder concern (S)** – consideration of other users, interest groups, media and the general public, and perceived potential impacts; and
- **Regulatory compliance (R)** – consideration of current and anticipated future legislative requirements.

This three pronged approach allows important consideration of public/stakeholder perception of a project as well as scientifically measured potential impact. Once each of the three consequences has been assessed, a final single rating for the potential impact must be assigned. Overall ranking is undertaken using agreed rules applied by experienced assessors.

Key rules employed are:

- A potential impact rated as sever by any consequence driver remains severe;
- A potential impact rated major by any driver usually remains major;
- Major regulator (R) consequence makes the final ranking major;
- A potential impact ranked as moderate for two or three drivers is seriously considered for major ranking in the overall ranking;
- All lower rankings are examined for important negative criteria before overall ranking can be considered negligible; and
- In the cases of uncertainty, the highest ranking of the three should be taken as the final ranking.

Table 6.2 Environmental consequence (magnitude) criteria definitions

Category	Regulatory compliance (R)	Potential environmental impact (E)	Stakeholder concern (S)
Severe	Activity prohibited. Likely major breach of regulatory requirements resulting in non-compliance or significant project approval delays.	Regional (widespread) potential impact on the quality or availability of a habitat and / or wildlife with no recovery expected or irreversible alteration (permanent). Long-term effect on the conservation objectives of nationally / internationally protected sites, habitats or populations. Major transboundary effects expected. Major contribution to cumulative effects.	International public concern and extensive international media interest likely. Well established and widely held areas of concern in society, including perception of threat to the global environment. Decrease in the availability or quality of a resource to the extent of affecting over five plus years the wellbeing of the persons using that resource e.g. loss of fishing access or recreational use. Potential major effect on human health.

Category	Regulatory compliance (R)	Potential environmental impact (E)	Stakeholder concern (S)
Major	Possible major breach of specific regulatory consent limits resulting in non-compliance.	Regional (widespread) potential impact on the quality or availability of a habitat and / or wildlife and where recovery may take place over the long term and could involve significant restoration effort. Short-term potential impact on the conservation objectives of nationally / internationally protected sites, habitats or populations. Moderate transboundary effects expected. Moderate contribution to cumulative effects.	National public concern and extensive national media interest likely. Well established and widely held areas of concern in national society. Decrease in the availability or quality of a resource to the extent of affecting over two to five years the wellbeing of the persons using that resource. Potential moderate impact on human health.
Moderate	Possible minor breach of specific regulatory consent limits resulting in non-compliance.	Regional (widespread) change in a habitat or species beyond natural variability with recovery likely within the short-term following cessation of activities, or localised degradation with recovery over the long-term following cessation of potential impact / activity. Potential impact on the conservation objectives of locally important sites or species. Possible transboundary effects Possible contribution to cumulative effects.	Regional concerns at the community or broad interest group level. Decrease in the availability of a resource to the extent of affecting over one to two years the wellbeing of the persons using that resource. Possible but unlikely effect on human health, but may result in or be perceived to result in a minor potential impact.
Minor	Regulatory terms set defined conditions.	Regional (widespread) change in habitats or species which can be seen and measured, but is at same scale as natural variability or localised change in a habitat or species beyond natural variability with recovery expected in the short term following cessation of potential impact or activity. Unlikely to contribute to transboundary or cumulative effects.	Issues that might affect individual people or businesses or single interests at the local level. Some local public awareness and concern. A short-term decrease in the availability or quality of a resource likely to be noticed by persons using it, but does not affect their well-being.
Negligible	No likelihood of breach of regulatory, corporate or company goals.	Effects unlikely to be discernible or measurable . No contribution to transboundary or cumulative effects.	No noticeable stakeholder concern and only limited public interest. A possible short term decrease in the availability or quality of a resource, which is unlikely to be noticed by persons using it, or those who live in the immediate area, and does not affect their well-being.
Positive	N/a	An enhancement of some ecosystem or population parameter.	No public opposition. Positive public support. An enhancement in the availability or quality of a resource to the extent of potentially benefiting the wellbeing of the persons using that resource or benefiting from it in some way.

6.3.3 Likelihood of potential impact

In order to assess the significance of a potential impact, the overall consequence is combined with the likelihood (frequency / probability) of the potential impact occurring. Frequency and probability categories are defined in Table 6.3. Definitions are provided for routine / planned events as well as for accidental / unplanned events.

Table 6.3 Probability and frequency guidance

Frequency / probability category	Routine (planned) operation frequency	Accidental event (probability)
5	Continuous emission or activity over life of field or development.	Likely. More than once per year. Event likely to occur more than once on the facility.
4	Regular emission or activity. Once per year for ≤ 6 months OR Once per month for ≤ 15 days OR Once per day for ≤ 12 hours.	Possible. One in 10 years. Could occur within the lifetime of the development.
3	Intermittent emission or activity. Once per year for ≤1 month OR Once per month for ≤ 3 days OR Once per day for ≤ 2 hours.	Unlikely. One in 100 years. Event could occur within lifetime of 10 similar facilities. Has occurred at similar facilities.
2	One off event or activity over lifetime of development of ≤ 3 months duration OR Once per year for ≤ 5 days OR Once per month for ≤ 8 hours.	Remote. One in 1,000 years. Similar event has occurred somewhere in industry or similar industry but not likely to occur with current practices and procedures.
1	One off event or activity of ≤ 10 days duration.	Extremely remote. One in 10,000 years. Has never occurred within industry or similar industry but theoretically possible.

6.3.4 Overall risk and impact significance

For every impact, the potential environmental risk is obtained by combining the consequence and frequency or likelihood via the matrix presented in Table 6.4. Both components are at best semi quantitative representing best judgements on the basis of knowledge and experience available. A simple matrix provides a consistent basis for presenting such a broad based risk assessment. Interpretation of the overall risk in terms of potential significance can then be undertaken as outlined in Table 6.4.

Table 6.4 Environmental risk

Consequence	Likelihood				
	5	4	3	2	1
	Continuous / Likely	Regular / Possible	Intermittent / Unlikely	One off event / Remote	One off event / Extremely remote
Severe	Severe	Severe	Major	Moderate	Minor
Major	Severe	Major	Moderate	Minor	Negligible
Moderate	Major	Moderate	Minor	Minor	Negligible
Minor	Moderate	Minor	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible	Negligible
Positive	Positive	Positive	Positive	Positive	Positive

Table 6.5 Impact significance

	Environmental risk	Potential impact significancef
Severe	Elevated risk - requires major consideration in design process and / or operational planning.	Significant
Major	Elevated risk - requires immediate attention and major consideration in design process and / or operational planning.	Significant
Moderate	Moderate risk - requires additional control measures where possible or management / communication to maintain risk at less than significant levels.	Not significant providing additional management measures in place
Minor	Minor risk - however will require some management / commitment to maintain risk at less than significant levels.	Not significant
Negligible	No risk - no action required.	Not significant
Positive	Positive – to be encouraged.	Positive significance

6.4 Mitigation and Assessment of Residual Impacts

Where potentially significant impacts are identified, mitigation measures are considered. The intention is that such measures should remove, reduce or manage the potential impacts so that they are not significant. For some potential impacts, mitigation has been identified even where potential impacts are considered to be insignificant. In these instances mitigation is recommended to maintain potential impacts at insignificant levels.

The findings of the detailed assessment of the impacts identified in Table 6.1 are presented in subsequent ES sections, including details of the mitigation and an assessment of residual impact significance.

6.5 Cumulative and In-Combination Impacts

Cumulative and in-combination impacts are described as the effects that result from incremental changes caused together with other past, present or reasonably foreseeable actions. In the case of the Rev infrastructure, this includes (but is not limited to) the decommissioning activities associated with the Rev field in the Norwegian sector, other nearby oil and gas activities and any other potential projects in this area of the North Sea. Potential cumulative and in-combination impacts have been considered throughout the EIA and are assessed in the following impact sections (sections 7 – 12)

It is noted that the level of detail that is available for other planned, proposed (in preparation for application submission) and approved (consent awarded) projects/developments and projects that are under construction will vary from project to project. Taking this into account, the assessment of cumulative impacts usually can only be carried out on a qualitative basis using expert judgement to identify and determine the significance of any potential impacts. For a decommissioning project such as the Rev UKCS Decommissioning Project, the key potential mechanism by which cumulative impact could result is the forthcoming decommissioning of numerous assets in the North Sea and due consideration has been given to this as part of the in the relevant impact assessments.

6.6 Transboundary Impacts

The EIA Directive requires special procedures in the case that a project may have potentially significant impacts on the environment of other countries (any European Economic Area (EAA) State[3]). For the purposes of providing adequate and effective consultation, any country which may be an affected party should be consulted. Each of the impact sections (sections 7 – 12) identifies the potential for transboundary impacts.

6.7 Protected Habitats and Species

A closely linked and integral aspect of the EIA process is the requirement to inform a Habitats Regulations Appraisal (HRA) under the European Habitats Directive. HRA requires the competent authority, in this case BEIS, to determine if a project or proposal may significantly impact the integrity of a Natura site. Natura sites include Special Protection Areas (SPAs) and Special Areas of Conservation (SACs). A similar process is required by the Marine and Coastal Access Act (2009) and the Marine (Scotland) Act 2010 for consideration of Nature Conservation Marine Protected Areas (NCMPAs) (the potential for significant risk to the conservation objectives being achieved must be assessed).

It is an offence to intentionally or recklessly capture, kill, injure, harass or disturb animals protected under the Habitats Directive (European Protected Species - EPS). It is also an offence to deliberately or recklessly obstruct access to a breeding site or resting place for such an animal or otherwise deny the animal use of the breeding site or nesting place and to disturb such an animal in a manner that is, likely to significantly affect the local distribution or abundance of the species to which it belongs. An EPS Licence is required for any activity that might result in disturbance to an EPS.

Potential impacts on internationally protected habitats and species are considered as relevant in each impact section of the ES.

3 EEA state is defined as a party to the Agreement on the European Economic Area, not just EU member states. Consideration of potential transboundary impacts as required under the EIA Directive and UNECE Convention on EIA in a Transboundary Context (the Espoo Convention).

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7 Energy Use and Emissions

7.1 Introduction

This section examines the energy use that will occur as a result of the Rev UKCS Decommissioning Project and presents an assessment of the atmospheric emissions associated with this energy use. The assumptions made to inform the energy use and emissions assessment for the Rev UKCS Decommissioning Project, present a worst case assessment. As final details of the decommissioning activities are developed, it might be that some of the activities assumed to take place in the UKCS or onshore UK in fact take place in the Norwegian sector or onshore Norway. Where this could be the case it has been indicated.

7.2 Description and quantification of impact

The use of fuel to execute the Rev UKCS Decommissioning Project will result in emissions of gases to air that could potentially result in impacts at a local, regional, transboundary and global scale. Local, regional and transboundary issues include the potential generation of acid rain from nitrogen and sulphur oxides (NOX and SOX) released from combustion, and the human health impacts of ground level nitrogen dioxide (NO_2), sulphur dioxide (SO_2), both of which will be released from combustion and ozone (O_3), generated via the action of sunlight on NOX and volatile organic compounds (VOCs). On a global scale, concern with regard to atmospheric emissions is largely focused on global climate change. The Intergovernmental Panel on Climate Change (IPCC) in its fifth assessment report states that the dominant cause of observed warming is anthropogenic greenhouse gas (GHG) emissions (IPPC, 2014). GHGs include water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N2O), O_3 and chlorofluorocarbons. The most abundant GHG is water vapour, followed by CO_2. IPCC (2007) states that the combustion of fossil fuels is the primary contributor to CO_2 emissions.

Atmospheric emissions from the Rev UKCS Decommissioning Project will occur as a result of:

- Fuel consumption by vessels;
- Movement and treatment of materials brought to shore (could be either the UK or Norway); and
- Replacement of anthropogenic materials decommissioned *in situ* offshore.

The assumptions on vessel use and on the materials inventory for the Project that have been used to inform the energy use and atmospheric emissions calculations are detailed in section 3.6.3.2. An estimate of the energy use and associated atmospheric emissions is provided in

Table 7.1. These estimates include vessel use, recycling of material brought to shore and the replacement of any materials decommissioned in situ (materials decommissioned in situ will not be available for reuse or recycling and this is accounted for in the assessment by considering the energy and emissions associated with creating that material). It is not yet known whether vessels will transit from the UK or Norway and the final destination of infrastructure brought to shore could be either the UK or Norway. The distance from the Rev UKCS Decommissioning Project to either coastline is very similar and given this, it is anticipated that the following impact assessment would be relevant to either outcome.

Table 7.1 Estimated energy use and resulting atmospheric emissions from the Rev UKCS Decommissioning Project

Activity	Atmospheric emissions (tonnes)		
	CO_2	NO_x	SO_2
Decommissioning of export pipeline including removal of concrete mattresses	263.11	4.9	1.00
Decommissioning of umbilical including removal of concrete mattresses	434.29	8.08	1.64
Post-decommissioning survey overtrawl	206.05	3.84	0.78
Post decommissioning monitoring surveys	618.15	11.51	2.34
Onshore transportation, dismantling and recycling (either UK or Norway)	109.79	0.50	45.15
Replacement of material left *in situ*	1,693.44	3.14	4.93
Total	**2,421.38**	**31.96**	**55.84**

7.3 Mitigation and Management

Repsol will ensure that correct management procedures are in place to ensure the following:

- Use of low sulphur diesel;
- Operations will be carefully planned to reduce vessel numbers and the duration of operations;
- All vessels will comply with the Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2014;
- 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;
- All vessels will have the appropriate UK Air Pollution Prevention or International Air Pollution Prevention certificates in place as required;

Onshore facilities will have appropriate management procedures in place to ensure that atmospheric emissions, including those from movement of materials, are below levels that could affect local air quality

7.4 Cumulative and In-Combination Impacts

The majority of the decommissioning activities are too remote from other industrial activities (including other offshore oil and gas activity) for there to be any likely cumulative effects in terms of local air quality. Whilst there may be an increase in emissions nearshore or onshore, the additional potential emissions are sufficiently low that no cumulative impact on local air quality is expected.

The issue of atmospheric emissions in terms of global climate is a specifically cumulative one. To understand the potential impact from the atmospheric emissions associated with the Project, it is useful to set the emissions in the context of wider UK emissions. Whilst, an exact figure for offshore emissions in UK waters does not exist, the contribution of emissions from shipping activities can be summed with

oil and gas industry emissions to provide a benchmark against which the Rev UKCS Decommissioning Project can be considered. The latest available total annual CO_2 emissions estimate from oil and gas exploration and production is 13,232,726 tonnes (for 2015, Oil and Gas UK, 2016) and the latest total annual CO_2 emissions estimate for UK shipping is approximately 11,000,000 tonnes (for 2013, DECC, 2015, cited in Committee on Climate Change, 2015a), giving a total of 24,232,726 tonnes of CO_2. The total CO_2 emissions from the decommissioning activities are estimated to be approximately 2,421.38 tonnes, which will contribute approximately 0.0002% of the atmospheric emissions associated with UK offshore shipping and oil and gas activities. The emissions from the Project will thus likely have a limited cumulative effect in the context of the release of GHGs into the environment and their contribution to global climate change.

It is useful to also consider how activities related to the Rev UKCS Decommissioning Project, but which are out of scope of the EIA may also contribute in an atmospheric context. For example, decommissioning of the Norwegian sector of the Rev field and also the nearby Armada Hub Decommissioning Project and the Varg Decommissioning Project. These projects are not anticipated to produce significant emission, it is also anticipated that the Rev UKCS Decommissioning Project will produce minimal emissions therefore the potential for a cumulative impact as a result of emissions is considered limited.

It is worth noting that the Rev UKCS Decommissioning Project will contribute to the removal of emissions produced as a result of the operational Rev field.

7.5 Transboundary Impacts

Although the Rev Decommissioning Project as a whole crosses the UK Norway median line, the scope of this EIA is limited to the UK sector (the Norwegian sector is subject assessment under Norwegian regulations). The Rev UKCS Decommissioning Project extends to the UKCS/Norway median line. With regards to air quality, due to the lack of receptors (humans) in the offshore Norwegian sector, there will be no significant transboundary impacts in this respect.

With regards transboundary impacts, the impact assessment presented above for cumulative impact demonstrates that the Rev UKCS Decommissioning Project will make no significant contribution to UK emissions to the global atmosphere. As such, there will be no significant transboundary impacts. It should be noted here, as above, that the activities are being enacted to decommission the Rev field, thus eliminating the operational emissions, and having the net effect of reducing annual emissions to air over time.

7.6 Residual Impact

Considering all of the above, including that the anticipated emissions from the Rev UKCS Decommissioning Project are limited and will be offset to a degree by the elimination of the operational emissions from the Rev field, effects are unlikely to be discernible or measurable and the magnitude of impact is ranked as minor. On the basis that emissions will be released for short periods of time over a period of years the frequency of the impact has been classed as intermittent, when combined with the magnitude ranking, a minor environmental risk is anticipated and thus the impact is considered not significant.

Magnitude	Frequency	Environmental risk	Significance
Minor	Intermittent	Minor	Not significant

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8 Discharges to Sea

8.1 Introduction

The Rev UKCS Decommissioning Project has the potential to impact on the water column and users of the water column through the release of chemicals and hydrocarbons. This may happen during the disconnection and cutting of the pipeline and umbilical in preparation or over a longer period of time from 12" export pipeline which will be decommissioned *in situ*. The assumptions made to inform the discharges to sea assessment for the Rev UKCS Decommissioning Project, present a worst case assessment. As final details of the decommissioning activities are developed, it might be that some of the activities assumed to take place in the UKCS or onshore UK in fact take place in the Norwegian sector or onshore Norway. Where this could be the case it has been indicated.

8.2 Description and Quantification of Impact

8.2.1 12" inch export pipeline

Prior to decommissioning the export pipeline will have undergone flushing and cleaning and will have been allowed to fill with seawater. It is possible where infrastructure has been left in situ that any residual hydrocarbon adhered to the pipeline structure may be released over a longer period of time as the pipeline degrades in situ. However the levels of residual hydrocarbon will be negligible.

8.2.2 Umbilical

The umbilical is to be fully removed from its trenched and buried location. It will have been flushed and cleaned and allowed to fill with sea water ahead of decommissioning, therefore there is no risk of chemical release upon removing the umbilical.

8.2.3 Concrete mattresses

A total of 70 concrete mattresses will be removed from the export pipeline and the umbilical. These materials are inert, self-contained and will not result in any discharge of hydrocarbons or chemicals to sea. Therefore there are no potential impacts of stabilisation material and deposit removal. An inspection of the mattresses has been carried out and has indicated that the mattresses are in a suitable condition for removal.

8.3 Mitigation and Management

The relevant permits and consents will be in place for the discharge of residual hydrocarbons in the UKCS from the decommissioning of subsea infrastructure.

The cleanliness of the flushed oil-containing pipelines represents the lowest reasonably practicable level that can be achieved and the maximum potential quantity of hydrocarbons discharged during the operations will be very small. In addition environmental samples will be acquired to characterise the condition of the sediment chemistry and macrobenthos when decommissioning is complete and this sampling will be periodically repeated to identify any changes.

8.4 Cumulative and In-Combination Impacts

It is possible that any hydrocarbon discharges occurring within the Project area, and from other assets in the area (during other planned decommissioning activities), could act cumulatively to result in an adverse impact to the surrounding environment. There will be no discharge of hydrocarbon on cutting the export pipeline as flushing and cleaning will have removed all but a negligible residual volume. This residual hydrocarbon could be discharged overtime as the pipeline degrades. In terms of how this

discharge fits into the context of existing discharges into the North Sea, information reported by (OGUK, 2016a) on operational discharges is useful. Operational discharges into the North Sea are reported as approximately 2,700 m^3 annually (OGUK, 2016a). The discharge from residual hydrocarbons from the export pipeline decommissioned *in situ* will be negligible in comparison. Furthermore, it is important to note that the activities described herein are being executed to facilitate the decommissioning of the Rev field; decommissioning means that there will be no further operational discharges to sea associated with the Rev field.

There will be other discharges to sea as a result of decommissioning of the Norwegian sector of the Rev field, the Varg field and the Armada Hub. As a result of the water depth and the minimal quantities of hydrocarbons potentially released as a result of the Rev UKCS Decommissioning Project over time, any discharge is expected to dissipate relatively rapidly and have a very limited environmental impact. Taking this into account and the likelihood that any discharges as a result of other decommissioning activities will not occur simultaneously with discharges from the Rev UKCS Project it is considered that there will be no cumulative impact as a result of discharges from the Rev UKCS Decommissioning Project.

8.5 Transboundary Impacts

Although the Rev Decommissioning Project as a whole crosses the UK Norway median line, the scope of this EIA is limited to the UK sector (the Norwegian sector is subject assessment under Norwegian regulations). There is the possibility that any hydrocarbon discharge to sea over time as the pipeline degrades in the UKCS could cross the median line. However, the sea conditions experienced within the northern North Sea would be expected to rapidly dilute and disperse the limited potential volume of residual hydrocarbons such that they are undetectable. As such, no transboundary impact is predicted.

8.6 Protected Sites

As detailed in section 5.6, the Rev UKCS Decommissioning Project is located approximately 4.5 km from the Norwegian Boundary Sediment Plain NCMPA. It is considered that any discharge of residual hydrocarbon over time as the pipeline degrades will occur sufficiently far from the NCMPA to mean that there is no mechanism of impact. As with other hydrocarbon discharge activities in the North Sea, the prevailing hydrodynamic conditions will assimilate any discharges to ambient conditions through natural dispersion and dilution.

8.7 Residual Impact

Users of the water column and seabed around any discharge locations will have some tolerance to accommodate the particular effects that could result from discharges (as a result of depth and refreshing of water column) and sensitivity is low. As potential impacts are not likely to affect the long term function of a system or a population, there will be no noticeable long term effects above the level of natural variation experienced in the area and vulnerability is low. The fish populations in the Project area are characterised by species typical of the central North Sea, with some spawning and nursery regions for commercially important fish and shellfish species occurring in the vicinity of the Project area. There appear to be low densities of cetaceans and seals within the Project area. There are no designated or proposed sites of conservation interest in the immediate Project area. None of the survey work undertaken in the Project area has identified any benthic habitats or species that are of specific conservation significance. Value is therefore defined as low.

The impact magnitude is considered minor because any hydrocarbons that may be discharged will be negligible in volume and the total volume of hydrocarbons that may be discharged is extremely low and at concentrations below recognised marine discharge toxicity thresholds. The discharge is considered to be a remote event and therefore the environmental risk is deemed to be negligible and thus the impact is not considered to be significant.

Magnitude	Frequency	Environmental risk	Significance
Minor	Remote	Negligible	Not significant

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9 Other Sea Users

9.1 Introduction

The Rev UKCS Decommissioning Project has the potential to impact upon other users of the sea. This may happen during the decommissioning activities themselves, when vessels are working in the field and transiting to shore occupy space, and after decommissioning should any infrastructure decommissioned *in situ* interact with activities such as fishing. The assumptions made to inform the other sea users assessment for the Rev UKCS Decommissioning Project, present a worst case assessment. As final details of the decommissioning activities are developed, it might be that some of the activities assumed to take place in the UKCS or onshore UK in fact take place in the Norwegian sector or onshore Norway. Where this could be the case it has been indicated.

9.2 Description and Quantification of Impact

9.2.1 Increased vessel traffic leading to temporary exclusion from sea area

The temporary physical presence of Project vessels in the UK sector (originating from either the UK or Norway) has the potential to interfere with other sea users that may be present in the area. Vessels will be required for a duration of approximately 29 days, this time includes decommissioning activities and post decommissioning surveys.

9.2.2 Snagging risk and exclusion from the Rev UKCS Decommissioning area

The Marine Accident Investigation Branch data show there have been 13 sinkings resulting from snagged fishing gear between 1989 and 2008, resulting in 22 fatalities (Marine Accident Investigation Branch, 2016). Once decommissioning activities have been completed there remains the potential for fishing gear to snag on infrastructure that has been decommissioned *in situ* i.e. the 12" export pipeline. However, the pipeline is currently trenched and buried and will remain inaccessible to fishing gear. There is a possibility that rock dump may be used on areas of the pipeline that are buried to less than 0.6 m and if it is not possible to bury the exposed pipeline end in a manner which avoids a snag hazard. In addition appropriate monitoring and remediation will take place to ensure that the pipeline remains suitably buried. As such, the decommissioning *in situ* of the 12" export pipeline is not expected to present a long-term snag risk.

There is the potential for the loss of objects during decommissioning activities (including post decommissioning surveys). Depending on size, dropped objects may present a hazard to fishing activities and pose a snag hazard which may result in exclusion from the area.

An overtrawling survey will occur immediately following decommissioning and a number of monitoring surveys will occur at intervals in the period following decommissioning. Whilst survey vessels are at the site of the Rev UKCS Decommissioning Project, fishing vessels will be excluded, however this will represent a minimal time (approximately four days total, over a number of years, in the field for all surveys).

9.3 Mitigation and Management

A number of mitigation measures will be employed to reduce the impact on other sea users:

- During decommissioning the number of vessels and length of time required on site will be reduced as far as practicable through careful planning of the decommissioning activities and information on the location of vessel operations will be communicated to other sea users through the standard communication channels including Kingfisher, Notice to Mariners and Radio Navigation Warnings (as appropriate);

- The subsea infrastructure is currently shown on Admiralty Charts and the Fishsafe system. Once decommissioning activities are complete, updated information on the Rev UKCS subsea area (i.e. which infrastructure remains *in situ* and which has been removed) will be made available to allow the Admiralty Charts and the Fishsafe system to be updated;
- The limited infrastructure decommissioned *in situ (*4.621 km of pipeline*)* will be buried to a sufficient depth and any exposed areas and cut ends will also be buried;
- Any objects dropped during decommissioning activities will be removed from the seabed as appropriate;
- An appropriate vessel will be engaged to carry out overtrawls to verify that the seabed has been left in a condition that does not present a hazard to commercial fishing. Final decommissioning activities will be considered to be complete subject to certification of seabed clearance by the SFF (or a similarly qualified body) and acceptance of the Decommissioning Close-out Report by BEIS.
- The post-decommissioning monitoring survey will confirm the depth to which the *in situ* decommissioned infrastructure is buried below the seabed as appropriate. Environmental samples will be acquired to characterise the condition of the sediment chemistry and macrobenthos when decommissioning is complete; and
- Repsol recognises its commitment to monitor any structures decommissioned *in situ* and therefore intends to set up arrangements to undertake post-decommissioning monitoring on behalf of the Licence Owners. The frequency of the monitoring that will be required will be agreed with BEIS and future monitoring will be determined through a risk-based approach based on the findings from each subsequent survey. During the period over which monitoring is required, the status of the infrastructure decommissioned *in situ* would be reviewed and any necessary remedial action undertaken to ensure it does not pose a risk to other sea users.

9.4 Cumulative and In-combination impact assessment

Fishing effort in the vicinity of the Rev UKCS Decommissioning Project is considered low compared to the wider North Sea (section 5.7.1.) Considerably more effort is focused elsewhere across the wider Northern North Sea, specifically targeting *Nephrops* grounds in the Fladen Ground. Considered alongside the relatively low levels of shipping activity in the vicinity of the Rev UKCS Decommissioning Project, the wide expanse of water available to navigate in and the limited number of vessels to be deployed for the Project, it is not anticipated that there will be any significant cumulative impacts with respect to temporary use of the sea area by decommissioning vessels.

As all infrastructure will either be removed or decommissioned *in situ* in an overtrawlable condition and as monitoring will be conducted to ensure the decommissioned *in situ* infrastructure remains overtrawlable, there is expected to be no cumulative impact (with regards exclusion from areas) with other structures decommissioned as part of the Rev UKCS Decommissioning Project, or indeed with other North Sea decommissioning projects.

There are estimated to be 457 safety zones in the central and northern North Sea on the UKCS (UKOilAndGasData, 2016). The Project will decommission a 4.621 km length of pipeline *in situ* on the seabed, but this will be left in an overtrawlable condition and will not represent areas of exclusion which would require a further safety zone.

9.5 Transboundary Impacts

Although the Rev Decommissioning Project as a whole crosses the UK Norway median line, the scope of this EIA is limited to the UK sector (the Norwegian sector is subject assessment under Norwegian regulations). As the Rev UKCS Decommissioning Project area is beyond the UK's 12 nm limit, EU and non-EU vessels are permitted to fish in the area, subject to management agreements including, for example, quota allocation and days at sea. No data are available on the origin of vessels fishing

specifically in the area, however given the relatively low effort recorded in the area and the overtrawlable nature of the infrastructure that is decommissioned *in situ*, there is no mechanism by which significant transboundary impacts could occur.

9.6 Residual Impacts

The effect of the Rev UKCS Decommissioning Project on other sea users will be largely short-term and localised. Taking this into account and the low fishing effort in the area the magnitude of the impact is considered minor. Factoring in ongoing surveys means the impact is ranked as being intermittent. When the magnitude and frequency are combined this provides a minor environmental risk and the impact is thus not considered significant.

Magnitude	Frequency	Environmental risk	Significance
Minor	Intermittent	Minor	Not significant

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10 Underwater Noise

10.1 Introduction

The assumptions made to inform the underwater noise assessment for the Rev UKCS Decommissioning Project, present a worst case assessment. As final details of the decommissioning activities are developed, it might be that some of the activities assumed to take place in the UKCS or onshore UK in fact take place in the Norwegian sector or onshore Norway. Where this could be the case it has been indicated.

Underwater sound is generated by natural sources such as rain, breaking waves and marine life, including whales, dolphins and fish (termed ambient sound). Industrial use of the marine environment adds additional sound from numerous sources including shipping, oil and gas exploration and production, aircraft and military activity. In this assessment, sound is used as a term for anything that an individual animal can hear. The term noise is used in this assessment to mean sound that may have some form of potential impact (for example, it may affect behaviour). Whilst all 'noise' is also 'sound', not all 'sound' is considered 'noise'.

Many species found in the marine environment use sound to understand their surroundings, track prey and communicate with members of their own species. Some species, mostly toothed whales, dolphins and porpoise, also use sound to build up an image of their environment and to detect prey and predators through echolocation. Exposure to natural sounds in the marine environment may elicit responses in marine species; for example, harbour seals have been shown to respond to the calls of killer whales with anti-predator behaviour (Deecke *et al*., 2002).

In addition to responding to natural sounds, marine species such as fish and marine mammals may also respond to man-made sound. The potential impacts of industrial noise on species may include impacts to hearing, displacement of the animals themselves and potential indirect impacts which may include displacement of prey species. Whilst there is a lack of species specific information collected under controlled or well-documented conditions, enough evidence exists for fish and marine mammals to suggest that sound may have a potential biological impact and that noise from man-made sources may affect animals to varying degrees depending on the sound source, its characteristics and the susceptibility of the species present (e.g. Nowacek *et al*., 2007, report this specifically for cetaceans).

As well as potential behavioural impacts of noise, marine mammals and fish exposed to an adequately high sound source may experience a temporary shift in hearing ability (termed a temporary threshold shift; TTS) (e.g. Finneran *et al*., 2005). In some cases, the source level may be sufficiently high such that the animal exposed to the sound level might experience physical damage to the hearing apparatus and the shift may not be reversed; in this case there may be a permanent threshold shift (PTS) (Southall *et al*., 2007), and the animal could be considered as being injured.

10.2 Description and Quantification of Impact

There are a number of activities that will occur during the decommissioning activities that could emit noise to the marine environment:

- Use of vessels;
- Underwater cutting:
- The pipeline will be cut at the trench transition. There is the possibility that it may need to be cut at the SSIV, rather than disconnected – although that will not be the base case for the activities, it is considered here as a worst-case possibility;
    - 150 m of pipeline is to be removed. This length of pipeline will be cut into sections and recovered to the vessel; and
    - The umbilical will be cut in Norway waters in order to initiate reverse reeling. There is the possibility that the umbilical will need to be cut at the junction box

rather than disconnected - although that will not be the base case for the activities, it is considered here as a worst-case possibility.

- Repsol do not intend to use explosives as part of the decommissioning activities.

10.2.1 Vessels and marine mammals

Noise emissions from vessels occur continuously during operation of the vessel, appearing louder as animals approach the vessels, and appearing quieter as animals move away. Such continuous noise sources are generally of less concern than intermittent sources (e.g. such as seismic conducted during exploration activities) where relatively high doses of noise can be received by animals over a very short period of time with little warning. In terms of the typical noise emissions from the vessels to be deployed in the decommissioning activities, including during the post-decommissioning surveys, a review of the literature suggests that they will be in the range 174 – 188 dB re 1 µP @ 1 m (e.g. Hannay *et al*., 2004, MacGillivray and Racca, 2006, McCauley, 1998). Published thresholds at which injury (defined as permanent shift in hearing ability) might occur for marine mammals (Southall *et al*., 2007) suggest that noise emissions of in excess of 215 dB re 1 µ @ 1 m would be required for injury to occur.

Although noise emissions from vessels are not expected to cause injury, they may be sufficiently loud for marine mammals to find the noise a nuisance and to remove themselves from the area for the duration of activities. Such exclusion might be considered significant if it occurred for extended periods of time in areas that were important for breeding or feeding (which does not apply to the Rev UKCS Decommissioning Project; see Section 5.3). Southall *et al*. (2007) note that behavioural reactions to noise by marine mammals are by no means consistent across species or individuals, and it is difficult to therefore state specific thresholds for impact. However, considering published data on noise emissions from vessels against possible thresholds for disturbance (e.g. NMFS, 2005, Southall *et al*., 2007) it is clear that there is the potential for animals to be disturbed to some degree.

It is important to note that behavioural changes such as moving away from an area for short periods of time, reduced surfacing time, masking of communication signals or echolocation clicks, vocalisation changes and separation of mothers from offspring for short periods, do not necessarily imply that detrimental effects will result for the animals involved (JNCC, 2010b). Temporarily affecting a small proportion of a population for a limited period of time would be unlikely to result in population level effects and would be considered as trivial. In contrast, affecting a large proportion for a long period of time may be considered non-trivial. The majority of vessels will be on site for a matter of a few days. In the context of low number of marine mammals likely to be found in the area, the likelihood of significant disturbance is low. There will be vessel use in nearshore waters as vessels transit to and from the offshore Rev UKCS Decommissioning Project. However, the time spent in nearshore waters will be extremely limited and the likelihood of significant disturbance is low.

10.2.2 Cutting and marine mammals

A number of subsea cuts will be made during the decommissioning of the pipeline and umbilical. As JNCC (2010b) report, although advances in cutting technology have reduced the requirement to use explosives to decommissioning structures in recent years (there will be no explosives use), the possibility of injury or disturbance occurring to marine mammals from cutting activities must still be assessed here. Anthony *et al*. (2009) reports the peak source level for oxy arc cutters as 148 dB re 1 µPa @ 1 m and for cable cutters at 163 dB re 1 µPa @ 1 m. Since field measurements undertaken to record cutting emissions in the context of potential effects on marine life are otherwise limited, a possible worst case assumption has been made that noise emissions from cutting may extend up to 195 dB re 1 µPa @ 1 m. Injury from these noise levels is not considered likely, should animals approach the cutting activity. However, if cutting activities continued for a sustained period of time and animals remained within close proximity then there exists the potential for injury through cumulative exposure. This is not considered a likely outcome for the Project, however, as cutting activities are likely to be intermittent and of limited duration (a matter of hours) at any one time.

As with vessel emissions, cutting noise could cause disturbance. The key proxy for the potential to disturb will be the length of the period over which the cutting will take place. For the Rev UKCS Decommissioning Project, it is estimated that cutting activities will take approximately 1 – 2 days in the context of the Rev area being of no specific importance to marine mammals, this very short period of

cutting operations is unlikely to result in disturbance that will significantly affect life functions such as breeding or nursing.

10.2.3 Fish

Popper *et al*. (2014) outline the possibility of fish being affected by various noise emitting industries, of which oil and gas is one. In the same way as marine mammals can be affected, it is possible that fish could be injured or disturbed if noise emissions are sufficiently high (e.g. De Robertis and Handegard, 2012). However, the vessels will be slow moving and fish will not experience any sudden bursts of sounds, such that they may choose to approach or move away, thus avoiding injury. For cutting, the emissions could be considered intermittent (even if the noise source is continuous), but the sound levels are predicted to be low. Even if some fish were to be injured by the emissions, many millions of individuals make up most species populations (e.g. Mood and Brooke, 2010) and limited injury is not likely to result in significant impacts at the population level. Similarly, should the noise emissions disturb fish, the short-term movement away from the short-term activities would not constitute a large-scale movement by individuals of a species and would be highly unlikely to result in population level impacts.

10.3 Mitigation and Management

The primary measure of reducing potential impact will be to limit the duration of the noise emitting activities; for example, vessels will only be deployed where necessary and the number of cuts will be limited as far as is practicable.

10.4 Cumulative and In-combination Impacts

It is possible that the various noise sources associated with the Rev UKCS Decommissioning Project (i.e.vessels operating at the same time, or cutting occurring at the same time as vessels being used) could result in an impact to marine mammals and fish. However, noise levels will be sufficiently low that injury is not expected for marine mammals, and potential disturbance zones are likely to be small and, for the most part, highly limited in temporal extent. For fish, the potential for injury or disturbance to result in any detectable changes at the population level is very low. Cumulative impact from sources within the Rev UKCS Decommissioning Project are therefore not expected. In the context of the number of vessels that use the North Sea for fishing, shipping, passenger transport, oil and gas activity, recreation and others, which will all emit noise, the scale of the additional 29 days of in-field/transit time required for vessels associated with the Rev UKCS Decommissioning Project are limited.

In theory, any project that regularly emits underwater noise has the potential to act cumulatively with the Rev UKCS decommissioning activities this includes the decommissioning of the Norwegian sector of the Rev field, the Armada Hub Decommissioning Project and and decommissioning of the Varg field.

Cetacean and fish populations are free-ranging and long-distance movement is likely to be frequent, and in some cases predictable through seasonal migration (e.g. mackerel; ICES, Undated). Any animal experiencing a significant impact from one project is likely to belong to a much wider ranging population and there is the potential for that same animal to subsequently come into contact with noise from other projects. However, potential injury and disturbance impacts resulting from the Project are not expected to be significant, and significant cumulative impact from an animal encountering noise emissions from multiple projects within a short period of time is therefore considered highly unlikely.

10.5 Transboundary Impacts

Although the Rev Decommissioning Project as a whole crosses the UK Norway median line, the scope of this EIA is limited to the UK sector (the Norwegian sector is subject assessment under Norwegian regulations). The geographical boundary of the activities assessed in this EIA therefore extend to the UK/Norway median line. Sound emissions could therefore be received directly by marine mammals and fish across median lines. However, since injury and disturbance are not expected to result in significant impact to any population, potential transboundary impacts are also therefore considered not significant.

10.6 Protected Sites

As described in section 5.5.5, four species of marine mammal listed on Annex II of the Habitats Directive occur in UK waters. The Rev UKCS Decommissioning Project is well beyond the predicted foraging range for bottlenose dolphin from the Moray Firth SAC, especially since this population is restricted largely to within the 20 m depth contour around the Scottish east coast. For grey and harbour seals, foraging range is approximately 200 km and 50 km respectively, which means that the Rev UKCS Decommissioning Project is also beyond the core foraging range for these species from coastal haul out sites. Since there is no potential for underwater noise emissions to interact with these species in any significant manner, there is concluded to be no likely significant effect on any SAC designated for these interests and it is not necessary to consider the conservation objectives or integrity of any sites in further detail. For harbour porpoise, animals making use of the Southern North Sea cSAC may also make use of the Rev UKCS Decommissioning Project area; harbour porpoise within the North Sea are known to form one biogeographical population that spans the North Sea as a whole (JNCC, 2015). However, there is expected to be no injury to harbour porpoise from the Project activities, and no effect of disturbance at the population level. As such, there will be no LSE on this protected site.

10.7 Residual Impact

Considering all of the above, including that effects unlikely to be discernible or measurable and on the basis that some of the species, such as harbour porpoise, are afforded protection, the magnitude of impact is ranked as moderate. The frequency is considered intermittent, cutting will only occur for a short period of time over a duration of days whereas vessel activity will occur for short periods over a number of years. When combined this gives a minor environmental risk. The impact is therefore not considered to be significant.

Magnitude	Frequency	Environmental risk	Significance
Moderate	Intermittent	Minor	Not significant

11 Physical Presence (Seabed Disturbance)

11.1 Introduction

The assumptions made to inform the physical presence assessment for the Rev UKCS Decommissioning Project, present a worst case assessment. As final details of the decommissioning activities are developed, it might be that some of the activities assumed to take place in the UKCS or onshore UK in fact take place in the Norwegian sector or onshore Norway. Where this could be the case it has been indicated.

The Rev UKCS decommissioning activities have the potential to impact the seabed in the following ways:

- Direct impacts:
  - Dredging around pipeline and umbilical cutting point(s);
  - Removal of infrastructure;
  - Rock dump; and
  - Overtrawls by chain mats.
- Indirect impacts:
  - Through re-suspension and re-settling of sediment.

The Rev UKCS Decommissioning Project is not in the vicinity of any cuttings piles and therefore no disturbance to cuttings piles will occur as a result of the Project.

11.2 Description and Quantification of Impact

For the purposes of assessing potential impacts as a result of the physical presence causing seabed disturbance the following assumptions have been made:

- Where the umbilical is to be removed by reverse reeling, there is considered to be a direct impact within a 1 m corridor along the length of the removed umbilical, and an indirect impact due to re-suspension of sediments.
- For the 150 m of export pipeline which is to be cut and removed, it is assumed a 3 m direct access to the seabed directly surrounding the pipeline.
- The area of indirect impact (due to sediment re-suspension and re-settlement) is assumed to be equal to the area of the item removed or placed, plus a 10 m buffer. Seabed sediments and presence of visible faunal tracks indicate the seabed environment is quiescent. Re-suspended sediments are therefore expected to re-settle within 10 m of the point of disturbance. Although finer particles may remain suspended for some time before resettling, the relatively low bottom currents suggest they will not be carried far;
- For mattresses which may be covered in some sediment, the area of indirect impact is assumed to be twice the direct area to ensure the potential disturbance is not underestimated;
- If rock dump is needed (not the preferred or anticipated option) it is assumed:
  - For the pipeline end that one bag of rock will be required and the direct impact will occur in a 1 m radius from the pipeline end, with the indirect impact. For the indirect area it is assumed it will be double the direct area; and
  - As a worst case it is assumed that 10% of the pipeline will require rock depth and that a 1 m corridor around the pipeline will be directly impacted and for the indirect impact a 10 m buffer will be added.

- It is assumed as a worst case that overtrawling will occur in area of a radius of 100 m around the export pipeline and umbilical (the Rev UKCS Decommissioning Project).
- The indirect impact area for overtrawling is assumed to be equal to the direct area plus an additional 10 m buffer to allow for sediment re-settlement.

In order to assess the impacts of the proposed operations, the area of potential disturbance must be quantified. The area of direct and indirect disturbance expected for each activity is presented in Table 11.1

Areas where decommissioning activities overlap have been accounted for, ensuring that the extent of potential for impact is not unrealistically overestimated. Overtrawls by chain mat to ensure the seabed is clear of obstructions are expected to create the biggest impact area, and will overlap all other activities; they have therefore been reported separately in Table 11.1

Table 11.1 Estimate of direct and indirect impact areas

Activity	Direct impact (m^2)	Indirect impact (m^2)
Removal of umbilical by reverse reeling (4.9 km in UKCS)	10,654.67	109,354.67
Removal of 150 m of pipeline	905.01	3,949.50
Removal of concrete mattresses	189.00	378.00
Possible rock dump of pipeline end	4.66	9.32
Possible rock dump in areas of low burial	1,251.21	11,474.37
Total from decommissioning operations above	**13,004.49**	**125,165.86**
Overtrawls	1,408,821.15	1,514,786.96
Calculations are based on the assumptions presented in 11.2 and infrastructure dimensions as per section 3. Additionally a diamter 0.159 m has been used for the umbilical and 0.33 m for the pipeline.		

Review of Table 11.1 shows that the main cause of seabed disturbance will be the overtrawls, which at a worst case will directly disturb an area of approximately 1,408,821.15 m^2 and indirectly disturb approximately 1,514,786.96 m^2.

11.2.1 Direct disturbance of seabed habitats

11.2.1.1 Mechanism of potential impact

Direct interaction by physical disturbance can cause mortality or displacement of benthic species in the potential impact zone.

The sites of all the decommissioning direct impacts will also be subject to overtrawling, which represents the largest direct impact area. Therefore to avoid double-counting, the total area of direct impact quoted here corresponds to the area covered by overtrawling. It is the intention for the overtrawl survey to be carried out as soon as possible following decommissioning of the infrastructure. It is estimated that a total of approximately 1,408,821.15 m^2 of seabed will be directly impacted during overtrawling

operations, and this is the main focus of the assessment. Other activities are however discussed below where they are considered to present different impacts.

11.2.1.2 Rockdump

It is not anticipated that rockdump will be required for the Rev UKCS Decommissioning Project. However if the cut pipeline end is not able to be satifactorily buried a very small amount of rock dump will be required to prevent the cut end presenting a snag hazard. The volume will be sufficiently minimal to avoid any notable disturbance to the seabed. Areas of low burial (0.6m) along the length of the pipeline decommissioned *in situ* could also require rock dump. A pipeline inspection survey carried out in March 2017 (Deep Ocean, 2017) has shown that burial depth of the pipeline is no less than 1.0 m along its length and on average burial depth is 1.5 m so it it is not antiicpated that the rock dump will be needed, however this can not be confirmed until decommissioning activities commence. As a worst case if rock dump was required at both the pipeline end and to cover 10% of the pipeline left in situ a total of 1,251.21m^2 of seabed will be directly impacted and a total of 11,474.37 m^2 will be indirectly impacted. This is not considered a large area of impact in relation to the amount of similar avialble habitat for benthic species in the vicinity and will ensure there are no snagging hazards on the seabed.

11.2.1.3 Overtrawls

The main mechanism of direct disturbance will come from overtrawling at the end of decommissioning activities. Impacts from the overtrawling may include mortality and injury, arising from crushing of benthic and epibenthic fauna that cannot move away, as well as disturbance of motile fauna as they move away from the area of disturbance. The sediment structure, including burrows of any animals present, will be disturbed. However, the scale of these impacts is small when compared to commercial trawling in the North Sea. Gray and Elliot (2009) report that an area equal to twice the total North Sea seabed is trawled annually.

The disturbance will occur within two main habitat biotope complexes, as identified in section 5.3; EUNIS biotope complex 'Circalittoral Muddy Sand' (A5.26) or 'Circalittoral fine sand' (A5.25) and 'Deep circalittoral sand (A5.27). Tyler-Walters *et al*. (2004) reported tolerance, recoverability and sensitivity related to disturbance of offshore biotope complexes. Information on the complexes in the Rev UKCS Decommissioning area are deemed insufficient to assign such rankings, but two biotopes that sit within the A5.26 complex have sensitivity information available to describe them:

- '*Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand' was deemed to have low sensitivity (with medium resistance and high recovery) to abrasion, increases in suspended solids and smothering (De-Bastos, 2016); and
- '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' was deemed to have medium sensitivity to abrasion (low resistance and high recoverability), no sensitivity to increased suspended solids and low sensitivity to smothering (medium resistance and high recovery) (Tillin and Budd, 2016).

It is expected that some damaged individuals will recover *in situ*, and lost individuals will be replaced by recruitment from the surrounding area. The seabed in the area is relatively homogenous with a diverse fauna and represents a good source of larvae and migrating adults to support population recovery.

The ocean quahog is listed on the OSPAR (2008) List of threatened and declining habitats and species and is a qualifying species for the Norwegian Boundary Plain NCMPA, located approximately 4.5 km away. No examples of the species have been recorded in recent surveys at the Rev location (Fugro, 2006, Gardline, 2009a) although it is possible that they may occur there. The ocean quahog is considered to be moderately tolerant of smothering. It is a burrowing species that can switch between suspension and surface deposit feeding. It is thought to preferentially engage in suspension feeding, remaining buried in the sediment with its inhalant and exhalent siphons exposed. It periodically buries itself further in the sediment, respiring anaerobically often for one to seven days (although the longest record is 24 days) before returning to the surface (Tyler-Walters and Sabatini, 2008). It is therefore likely that any specimens that are buried by overtrawling will be able to recover to the surface before succumbing to anoxia. Ocean quahog is thought to be tolerant of increased suspended sediment levels. It is expected that it will be able to maintain its position in the sediment, and may temporarily switch to deposit feeding whilst disturbed sediment settles out (Tyler-Walters and Sabatini, 2008).

Hiddink *et al*. (2006) modelled the recovery time for benthic communities following disturbance by beam-trawling in the southern and central North Sea, which indicated that mud habitats on average took longer to recover (approximately 4 years) than higher energy sand and gravel areas (approximately 2 years). The Rev UKCS Decommissioning Project is located in the northern North Sea, in deeper waters than the communities investigated by Hiddink *et al*. (2006), however the seabed energy is likely to be the important factor. Bottom currents are low and the seabed is predominantly fine sand, indicating a probable recovery time in the middle of the quoted range. Based on the information above, trawling will impact habitats in the area, but impacts will be local and recovery is likely to occur within a matter of a few years.

11.2.1.4 Indirect disturbance of seabed habitats

The proposed activities may also lead to the smothering of benthic species and habitats due to sediment suspension and re-settlement (indirect disturbance). The estimated area of indirect impact is approximately 1,514,786.96 m^2, which represents the entire direct impact area with a 10 m buffer within which sediments may settle. As stated in the direct impacts section above, this area is negligible compared to the area of ICES rectangle 44F1 trawled every year by commercial fishing vessels.

Indirect impacts are increased suspended sediment load and re-settlement of sediments. The creation of higher than normal loads of sediment suspended in the water column, and the subsequent re-settling of that sediment has the potential for negative impacts on habitats and species through burial and/or smothering. This may particularly affect epifaunal species (Gubbay, 2003) with the degree of impact related to individuals' ability to clear particles from their feeding and respiratory surfaces (e.g. Rogers, 1990).

Sensitivity to smothering of the two biotopes within the 'Circalittoral Muddy Sand' complex that are described above is low, with medium to high resistance and high recovery (Tillin and Budd, 2016, De-Bastos, 2016). Species characterising these biotopes are expected to be exposed to, and tolerant of, short term increases in turbidity following sediment mobilisation by storms and other events. There may be an energetic cost expended by species to either re-establish burrow openings, to self-clean feeding apparatus or to move up through the sediment, though this is not likely to be significant. Most animals will be able to re-burrow or move up through the sediment within hours or days.

With regard to the settlement of re-suspended sediments, the infaunal community is adapted to fluctuations in sedimentation levels and not likely to be particularly sensitive to temporary and localised increases. Tillin and Budd (2016) report on the abilities of buried fauna to burrow back to the surface. Results indicate bivalves are able to burrow between 20 – 50 cm depending on species and substrate. The abilities of the fauna to recover to the sediment surface will depend on the species and the burial depth, but as overtrawling is not expected to result in deep burial, success should generally be high.

Defra (2010) states that generally impacts to the benthic environment arising from sediment re-suspension are short-term (over a period of a few days to a few weeks). These impacts on benthic habitats and species will be localised and are not expected to result in changes to the benthic community in the long-term.

No cuttings piles will be disturbed as a result of the Rev UKCS Decommissioning Project, therefore there is no risk of disturbing contaminated sediments.

11.3 Mitigation and Management

Repsol will select appropriate subsea contractors in line with its commitments to manage environmental impacts. As part of this, Repsol will require the contractor(s) to ensure that seabed interaction occurs in a controlled manner.

11.4 Cumulative and In-combination Impacts

The main impacts identified in this section are associated with disturbance of seabed sediment; direct disturbance and indirect disturbance through re-suspension and re-settlement of disturbed sediment. DECC (2016a) specifies that impacts are considered cumulative only if:

- The physical or contamination "footprint" of a predicted project overlaps with that of adjacent activities; or
- The effects of multiple sources clearly act on a single receptor or resource (for example a fish stock or seabird population); or
- Transient effects are produced sequentially.

In the vicinity of the Rev UKCS Decommissioning Project a number of other Decommissioning Programmes are also due to take place (Norwegian sector of the Rev field, Varg and the Armada Hub,). Although geographically close, none of these programmes share a physical footprint and the timings for activities are not known to be the same. Given the minimal amount of seabed disturbance estimated as a result of the Rev UKCS Decommissioning Project it considered unlikely that there will be a cumulative impact on benthic receptors as a result of direct or indirect seabed impacts.

Commercial fishing does produce significant physical disturbance; "in a UKCS context, the contribution of all other sources of disturbance are minor in comparison to the direct physical effects of fishing" (DECC, 2016a). The physical footprint of the Rev UKCS Decommissioning Project operations is not likely to overlap with fishing activity while decommissioning activity is ongoing, as the area experiences very little fishing and vessels will be required in only a few locations at any one point.

Overtrawling activities could be considered to target the same receptors as fishing vessels, although the intent with overtrawling is not to remove any fauna from the seabed, and the only impact (expected to be minimal) will be direct injury or mortality from the trawl mat. Rev UKCS decommissioning activities are expected to be transient, as are fishing impacts (the area is not heavily fished). Commercial fishing may begin immediately after decommissioning activities have finished and could therefore qualify as sequential transient events. The physical presence impacts associated with Rev UKCS decommissioning activities are expected to be short-term, and are on a small scale compared to the available habitat in the area. Ultimately the activities will result in a small amount of additional seabed habitat becoming available through removal of infrastructure and cessation of disturbance due to production operations. It is therefore considered unlikely that the proposed operations will result in cumulative seabed impacts with regards to commercial fishing.

11.5 Transboundary Impacts

Although the Rev Decommissioning Project as a whole crosses the UK Norway median line, the scope of this EIA is limited to the UK sector (the Norwegian sector is subject assessment under Norwegian regulations). The Offshore Energy SEA 3 for UKCS waters (DECC, 2016) states that seabed impacts from oil and gas operations are unlikely to result in transboundary effects and even if they were to occur, the scale and consequences of the environmental effects in the adjacent state territories would be less than those in UK waters and would be considered unlikely to be significant.

The Rev UKCS Decommissioning Project extends to the UK/Norway median line. Despite this transboundary impacts as result of seabed disturbance are anticipated to be minimal. Direct impacts will not have transboundary effects as they are limited to the physical footprint of activity which is all within the UKCS. Indirect impacts from sediment resuspension and resettlement may travel a few metres and therefore has the potential to cross the median line. However this will be at such a minimal scale that no impact is expected.

11.6 Protected Sites

Any potential seabed impacts associated with the Rev UKCS Decommissioning Project will not occur within any SAC, SPA, NCMPA or MCZ. In addition seabed impacts do not spread sufficiently far to interact with any protected areas, the nearest of which is 4.5 km away.

11.7 Residual Impacts

Taking into account the predicted impact and proposed mitigation, impacts due to physical presence are expected to localised, short term and in line with natural variability, with no cumulative or transboundary impact expected. When considering the magnitude of the impact, whilst it is true that the operations will leave visible indications on the seabed, effects are expected to be indiscernible and therefore the magnitude is considered to be minor. The event is considered to be a one off and thus combining frequency and magnitude the environmental risk is considered to be negligible and the impact is not significant.

Magnitude	Frequency	Environmental risk	Significance
Minor	Intermittent	Minor	Not significant

12 Accidental Events

12.1 Introduction

The potential impact of any accidental hydrocarbon or chemical release will be determined by the chemical characteristics of the release (including weathering potential), the circumstances and volume of the release, the environmental conditions at the time, the direction of travel of the release and the presence of environmental sensitivities in the path of the release. These environmental sensitivities will have spatial and temporal variations. Therefore, the likelihood of any accidental release having a potential impact on the environment must consider the likelihood of the release occurring against the probability of that hydrocarbon or chemical reaching a sensitive area and the environmental sensitivities present in that area at the time of hydrocarbon or chemical release. The assumptions made to inform the energy use and emissions assessment for the Rev UKCS Decommissioning Project, present a worst case assessment. As final details of the decommissioning activities are developed, it might be that some of the activities assumed to take place in the UKCS or onshore UK in fact take place in the Norwegian sector or onshore Norway. Where this could be the case it has been indicated.

12.2 Description and Quantification of Impact

Potential sources of accidental releases were reviewed during the ENVID and scoping process and the following were identified:

- Dropped object causing pipeline rupture;
- Accidental release at onshore decommissioning facilities; and
- Accidental release from a vessel. (at the offshore decommissioning site and on transit to the onshore dismantling site).

12.2.1 Dropped object causing pipeline rupture

There is the potential for the loss of objects during the decommissioning process. Dropped objects can vary in size from tools to large sections of infrastructure or the loss of a vessel. Depending on size, the dropped object may cause a rupture to subsea infrastructure including pipelines and umbilicals. As discussed in section 8.2.1, the export pipeline will be hydrocarbon free prior to the removal of any subsea infrastructure. No other oil and gas pipelines are within close vicinity to the aspects of the Project that require removal. The Rev field lines will be cleaned to a level which is as minimal as practicably possible. For these reasons, combined with the likelihood of this event occurring being remote, this impact has not been assessed further.

12.2.2 Accidental releases onshore

Once infrastructure has been transported to an onshore dismantling site(s) there is the potential for accidental hydrocarbon and chemical releases to occur, which may lead to contamination of land and groundwater of the surrounding environment. Hydrocarbon releases onshore are predicted to be minimal in quantity as all infrastructure will be hydrocarbon free before it reaches the dismantling site, and not contain any significant liquid inventory. Although the onshore site(s) has not been chosen yet, Repsol will ensure audits are carried out including a comprehensive review of prevention procedures and chemical storage areas are adequate at preventing accidental chemical releases. The magnitude of any chemical release is likely to be slight and the likelihood unlikely. For these reasons this impact has not been assessed further.

12.2.3 Accidental release from a vessel

Potential sources of accidental release from vessel operations include:

- Release of fuel inventory as a result of damage sustained during a collision, grounding or fire; and

- Storage tank failure resulting in a release of chemicals.

12.2.4 Behaviour of hydrocarbons at sea

The potential environmental impact of an accidental hydrocarbon release depends on a wide variety of factors, which include:

- Accidental release volume;
- Type of hydrocarbon released;
- Direction of travel of the slick;
- Weathering properties of the hydrocarbon;
- Any environmental sensitivities present in the path of the slick (these may change with time); and
- Sensitivity of the sea and beaching locations.

12.2.5 Environmental vulnerability to accidental releases

Environmental vulnerability is a function of both the likelihood of impact (as considered in previous sections) and the sensitivity of the environment. Offshore and coastal vulnerabilities need to be considered separately as different parameters will apply.

There can be impacts on plankton in the immediate area of the release for the duration of the release due to the dissolution of aromatic fractions into the water column. Such effects will be greater during a period of plankton bloom and during fish spawning periods. Contamination of marine prey including plankton and small fish species may then lead to aromatic hydrocarbons accumulating in the food chain. These could have long-term chronic effects such as reduced fecundity and breeding failure on fish, bird and cetacean populations. This may affect fish stocks of commercially fished species. A major release could also have a localised effect on the fishing industry, should certain areas be temporarily closed to fishing.

Juvenile fish and eggs are potentially the most sensitive life-stage to hydrocarbon discharges. As outlined in section 5.5.3 a number of commercially important pelagic and demersal fish species are found in the vicinity of the Rev UKCS Decommissioning Project.

The JNCC has stated in a memorandum to the UK Parliament that the greatest risks to nature conservation of oil on the offshore sea surface are to seabirds (JNCC, 2011). The seasonal vulnerability of seabirds to surface pollutants in the immediate vicinity of the Project, derived from JNCC block-specific data, suggest that seabirds in this area have an overall medium to high vulnerability to surface pollution, although some of the blocks exhibit very high vulnerability at certain times of the year. The magnitude of any impact will depend on the number of birds present, the percentage of the population present, their vulnerability to hydrocarbons and their recovery rates from oil pollution. The physical impact is one of plumage damage leading to loss of insulation and waterproofing.

Cetaceans are also present in the vicinity of the Rev UKCS Decommissioning Project (section 5.5.5) In the event of an accidental release, the potential impact, will depend on the species and their feeding habits; the overall health of individuals before exposure; and the characteristics of the hydrocarbons. It is thought unlikely that a population of cetaceans in the open sea would be affected in the long-term (Aubin, 1990). Baleen whales are particularly vulnerable whilst feeding, as oil may stick to the baleen if the whales "filter feed" near surface slicks. Cetaceans are pelagic (move freely in the oceans) and migrate. Their strong attraction to specific areas for breeding or feeding may override any tendency cetaceans have to avoid hydrocarbon contaminated areas.

The likelihood of an accidental hydrocarbon release impacting the coastal environment is a function of the likelihood of such an event occurring and the probability of the hydrocarbon beaching. The level of impact is also directly related to the volume of the hydrocarbons released, the volume of hydrocarbon beaching, the composition of the beached hydrocarbons, and the type of beach. The hydrocarbons

associated with the Project that may beach in the event of an accidental release are marine diesel from a vessel.

12.3 Mitigation and Management

The following provides an overview of proposed measures that either reduce the probability of an accidental release, or reduce the consequences:

- Review of spill prevention and response procedures;
- Procedural controls;
- Bunkering and storage arrangements;
- Vessel condition certificates;
- Vessel maintenance records;
- Evidence of crew competency; and
- Certification of equipment.

12.4 Cumulative Impact Assessment

It is important to consider the potential for cumulative impacts to arise from accidental events generated by the Project acting in conjunction with accidental events generated by other projects or activities occurring in the area.

The timing of other decommissioning activities in the vicinity are not known and it is assumed that the timescales will not overlap. There is thereofre not anticipated to be the possibility of higher than normal vessel densities in the area increasing the risk of a vessel collision.

Any accidental hydrocarbon release at the site of the Rev UCKS Decommissioning Project is expected to dissipate within days. It is considered very unlikely that additional accidental releases from other sources would occur in the same timeframe and produce a cumulative impact.

12.5 Transboundary Impact Assessment

Although the Rev Decommissioning Project as a whole crosses the UK Norway median line, the scope of this EIA is limited to the UK sector (the Norwegian sector is subject assessment under Norwegian regulations). The Rev UKCS Decommissioning Project reaches the UK-Norway median line. There is therefore the possibility that an accidental hydrocarbon release in the Project area would cross into the Norwegian sector.

In the event of an accidental hydrocarbon release entering Norwegian waters e.g. in the event of a large diesel spill, it may be necessary to implement the NORBRIT Agreement (the Norway-UK Joint Contingency Plan). The NORBRIT Agreement sets out command and control procedures for pollution incidents likely to affect both parties, as well as channels of communication and available resources. The MCA Counter Pollution and Response Branch also have agreements with equivalent organisations in other North Sea coastal States, under the Bonn Agreement 1983.

12.6 Protected Sites

12.6.1 Direct interaction with coastal sites from an offshore or nearshore release

Although there will be some limited requirement for vessels to transit nearshore as recovered infrastructure is transported to shore, this represents a very small percentage of overall vessel

requirements. As such, combined with the remote likelihood of an event occurring, direct interaction with any coastal or onshore protected sites is not expected to occur.

12.6.2 Direct interaction between an offshore release and receptors from coastal sites found offshore

In addition to direct interaction with a site (i.e. hydrocarbon crossing the boundary of a site), it is necessary to consider the potential that some qualifying features of some sites are mobile (e.g. seabirds, marine mammals) and that some individuals may forage or move through the area within which an accidental release has occurred. In terms of marine mammals for which sites are designated, as outlined in Section 5.4, bottlenose dolphins associated with the Moray Firth SAC are generally restricted to the 20 m depth contour in the Moray Firth and the Scottish east coast and are thus unlikely to be found in the vicinity of any potential hydrocarbon release that occurs offshore. Harbour popoise from the Southern North Sea cSAC may make use of the Rev UKCS Decommissioning Project area and thus could be encountered in the area that a hydrocarbon release may occur. However, they are not expected to be encountered in the vicinity in significant numbers and any hydrocarbon release will not impact on the population and as such, there will be no LSE on this protected site.

Given that any such release would not reach the UK coast and that harbour seals usually forage within 40 – 50 km of their haul-out sites (SCOS, 2014), there is unlikely to be any interaction with harbour seals from SACs on the east Scottish coast. Grey seals may forage up to 200 km from haul-outs (e.g. McConnell *et al*., 1999) and mainly on the seabed at depths of up to 100 m (SCOS, 2014). However, after breeding, most grey seals at a SAC disperse away from the site, making it very difficult to assign an individual to a particular SAC outside of the breeding season. Grey seal usage of an SAC is therefore very time and space-specific. On this basis, and reviewing available data on grey seal movements (e.g. Cronin *et al*., 2011, SMRU, 2011), it is considered that a 20 km radius around SACs may be used as a guide to the potential for interactions with projects. Given this distance, there is unlikely to be any interaction with grey seals from SACs on the east Scottish coast in the event of an offshore accidental hydrocarbon release due to activities ascoaited with the Rev UKCS Decommissioning Project.

In terms of seabirds that may move offshore from SPAs into the area of potential offshore hydrocarbon release, it is very difficult to apportion these birds to specific SPAs, as discussed by Furness (2014), which defines biological appropriate, species-specific, geographic non-breeding season population estimates for seabirds. Furness (2014) used existing data and literature in order to determine biologically defined minimum population scales for key seabird species. For many seabirds, once breeding is complete, individuals are no longer restricted to foraging within certain distances (i.e. foraging ranges) from their breeding colony as there is no longer any requirement to return to eggs or chicks. For a number of key species there is strong evidence that once birds leave the breeding colony they become widely dispersed over large distances, often intermingling with birds from other breeding colonies (typically of the same species) and in some cases birds that have migrated from overseas breeding colonies (Furness, 2014). Consequently, given that individuals from an SPA population become so widely dispersed, the potential for an accidental release from the project to impact any of these birds becomes significantly diluted as it is not possible to know which SPA birds present belong to. Potential impacts from an offshore release on birds during the non-breeding season (i.e. when they are offshore) are therefore expected to be negligible.

12.6.3 Direct interaction with offshore sites

For direct interaction with offshore sites without a land component, surface occurrence of released hydrocarbon within a site is taken as an indication that the site has the potential to be impacted. No modelling is available to show the fate of a release of vessel inventory from the location of the Rev UKCS Decommissioning Project but predictions can be made on the likelihood of an impact based on the characteristics of diese and the environmental conditions at the Rev location.

Marine diesel has a gravity of approximately 36.4°API and therefore floats on water. Once the lighter fractions of the hydrocarbon have evaporated, the remaining fraction is expected to form a stable water-in-oil emulsion. Therefore, given that the offshore sites located closest to the project (Norwegian Boundary Sediment Plain NC MPA) is in a water depth ranging from a minimum of 80 m to a maximum of approximately 120 m, it is very unlikely that hydrocarbons would be redistributed to these depths in

sufficient quantities or thickness to affect the protected seabed features. For these reasons, there is predicted to be no impact on sites designated for seabed features.

12.6.3.1 Protected species

There are several species that are known or expected to occur in the area which are protected but not associated with a site designation. Potential impacts on these species are discussed below.

Basking sharks, spurdog and blue shark are all on the IUCN red list; basking sharks are also protected under the Wildlife and Countryside Act 1981 (as amended). All three species may occur in the area, although not in numbers that are important in a population context, especially for the limited period over which a release would take to disperse. It is not expected that a release from a vessel at the Rev UKCS Decommissioning Project would have a significant impact on any of these three species.

12.6.3.2 Norway coastal sites

Several coastal areas in the Skagerrak area of Norway are regarded as important based on species, habitats , landscape, history and geology, these areas are termed Areas of Special Importance and as part of a managment plan for the North Sea and the Skagerrak area, these areas were analysed for vulnerability to various activities including oil and gas activities. All of the coastal areas were recorded as vulnerable. However given the distance from the Rev UKCS Decommissioning Project, the scale of any spill resulting from the Project and the predicted rapid disperion, it is not considered the Norwegian coastal sites will be subject to a significant environmental impact as a result of an accidental oil spill as a result of the Rev UKCS Decommissioning Project.

12.7 Residual Impacts

The worst case accidental event during decommissioning operations is expected to be the release of a vessel fuel inventory. Direct impacts may occur in the event of a release, the most serious of which could be the oiling of seabirds at the surface. Impacts are expected to be short-term and local, although there is a low probability of a localised transboundary impact. The likelihood that seabirds will be in the area in high numbers during the summer months when the vessels will be operating is high, although the number of seabirds present is expected to be low during most months (especially so during the summer months when they are breeding onshore and feeding nearshore). Seabirds are especially sensitive to surface oil pollution as it affects both their ability to fly and the effectiveness of their insulation. Receptor sensitivity is therefore expected to be high. It is however considered unlikely that there will be sufficient seabirds affected by a release at the Rev location to cause population-level impacts. It is likely that seabirds from the coastal SPAs on Shetland as well as other protected sites will use the area. In addition, the majority of species expected to use the site are protected under the Birds Directive (2009/147/EC). The receptor value is therefore considered very high.

Taking all this into account and the fact that the likelihood of a vessel inventory release is considered very low the environmental risk is expected to be minor. Therefore the impact is not considered to be significant.

Magnitude	Frequency	Environmental risk	Significance
Minor	Unlikely	Minor	Not significant

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13 Waste Management

13.1 Waste Generation

13.1.1 Introduction

An appropriately licensed disposal yard has not yet been selected, the location will either be in the UK or Norway. The selection process will ensure that the chosen facility is able to demonstrate a proven disposal track record and waste stream management throughout the deconstruction process, as well as the ability to deliver innovative reuse/recycling options. Legislation and waste management requirements of the destination country will be adhered to and Repsol's own waste management strategy applied in either location.

With regards transboundary movement of waste, OGUK (2016) report that 98% of all waste brought to shore from offshore oil and gas activities was processed in the UK, with just 1% transferred outside of the UK for processing (the disposal route for the remaining 1% of waste was not specified). Should Repsol select a dismantling yard outside of the UK, all appropriate transboundary reporting and tracking of waste will occur.

13.1.2 Routine vessel wastes and bulk liquids

The discharge of food waste, bilge water and grey water (water and chemicals from washing and laundry facilities) from vessels to sea during the decommissioning operations has the potential to cause short term, localised organic enrichment of the water column and an increase in biological oxygen demand. This could contribute to a minor increase in plankton and attract fish to the area. However, food waste is typically macerated to increase the rate of dispersion and biodegradation at sea and waste water will be treated appropriately before being discharged to sea, in accordance with the requirements of the MARPOL convention. Each vessel will have a relevant waste management plan in place.

13.1.3 Onshore dismantling

The anticipated waste streams include steel, copper, aluminium and NORM and potentially marine growth. All items of subsea infrastructure removed from the seabed shall be managed by a waste handling company once onshore, with disposal of the decommissioned equipment completed at an appropriately licensed waste management facility (or combination of facilities).

No significant marine growth is expected on the infrastructure brought ashore, any marine growth that does exist will be disposed of at landfill or composted.

13.1.4 Hazardous waste

Any hazardous wastes remaining in the recovered infrastructure e.g. NORM will be disposed of under an appropriate permit and as per Repsol's detailed hazardous waste strategy set out in the Waste Management Procedure (Repsol, 2016), which includes details on handling, storage and transport.

13.2 Waste Management

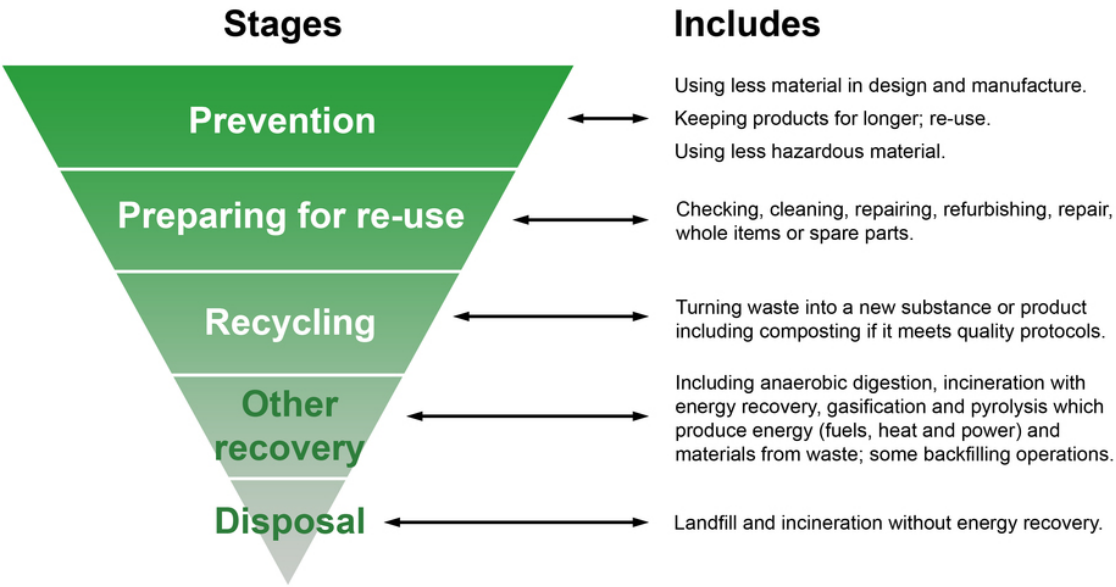
Repsol has a Waste Management Procedure (Repsol, 2016) included within its environmental improvement programme. Each Repsol facility must establish waste instructions that clarify the facility's routines for source separation. The waste hierarchy pyramid (Figure 13-1) illustrates the priorities in the Norwegian waste policy and the EU's Waste Framework Directive Repsol adheres to these principles, as they ensure the most environmentally friendly and cost effective results for the waste handling.

Waste reduction (to prevent the generation of waste) is the highest level in the waste hierarchy, while reuse is the second highest level. Waste reduction is an integral part of the plan for treatment of waste for Repsol.

As part of the waste management plan Repsol maintains a continuous emphasis on:

- Reducing the amount of waste generated;
- Reusing rather than discarding; and
- Reducing the amount of health hazardous and environmentally harmful substances in the waste.

Figure 13-1 Repsol waste management hierarchy



A Waste Management Plan will be developed for the Rev Decommissioning Project to further identify the types of waste generated and the management procedures for each waste stream. Repsol will ensure the principles of the Waste Management Hierarchy as described in Article 4 of the revised EU Waste Framework Directive are followed during the decommissioning activities. Transfer notes will accompany all non-hazardous waste to shore and consignment notes will be in place for any hazardous waste. Radioactive waste will be processed by a licensed facility capable of taking contaminated material under appropriate licences and disposing accordingly. Company procedures will be implemented during preparation of the material prior to returning to shore. The decommissioning activities will also be compliant with the Repsol Waste Management Procedure.

Checks will be carried out on the selected waste yard (UK or Norway) to ensure all permits and licenses are in place for the handling and disposal of the waste types identified. Repsol will ensure that waste is transferred by an appropriately licensed carrier (where applicable) who should have a Waste Carrier Registration, Waste Management Licence or Exemption, as appropriate for the type of waste. The selected waste contractor will be required to maintain a waste audit trail through to recycling or disposal facility.

14 Conclusions

14.1 Introduction

The EIA presented in this ES has been undertaken in support of the Decommissioning Programme that will be submitted for the Rev UKCS Decommissioning Project. The EIA has assessed the proposed decommissioning strategy in the context of the environmental sensitivities of the Project area and described the control measures that will be in place during Project execution. The EIA has also given due consideration to the decisions that remain to be made (e.g. dismantling yard location). The key findings of the EIA are summarised in the following sections.

14.2 Protected Sites and Species

This EIA has concluded that there will be no significant impact on any Annex I habitat (of the Habitats Directive). There are a number of offshore and coastal conservation areas on the Scottish mainland that have been designated under the Habitats Directive as SACs, under the EU Birds Directive as SPAs and under the Marine Scotland Act 2010 and Marine and Coastal Access Act 2009 as NCMPAs and MCZs. The potential for significant impacts on any such site has been considered within each impact assessment, with particular focus given to the Norwegian Boundary Sediment Plain NCMPA as the site is located 4.5 km away from the proposed activities. Given the short-term duration of the decommissioning activities, the mitigation measures in place and the expected recovery from activities, the Rev UKCS Decommissioning Project is considered unlikely to affect the conservation objectives or site integrity of any SAC, SPA, NCMPA or MCZ.

The majority of species protected under Annex I of the Birds Directive that are present within the North Sea will generally be found much closer to shore and may only encounter the Project with any regularity during the limited period of the vessel activity. Given such vessel use will result in only limited interaction with individuals of those protected species, the Rev UKCS Decommissioning Project will not result in significant impacts to those populations.

The presence within the area of species protected under Annex II of the Habitats Directive is limited to marine mammals. Marine mammal species that may be present occur in relatively low densities, or occur only occasionally, or as casual visitors. The EIA has assessed whether the noise emitting operations associated with the Project have the potential to result in injury or disturbance to any marine mammal species. This assessment concluded that there is a very low likelihood of injury (such as temporary or permanent hearing loss), or disturbance as a result of the activities associated with the project and that potentially significant environmental impacts would not result in population level impacts.

Considering all of the above, no significant impacts are expected upon protected sites, species and habitats.

14.3 Cumulative and Transboundary

A review of each of the potential environmental impacts associated with the Project, and the mitigation measures proposed against the range of other activities in the region indicates that no significant cumulative impacts are expected.

A review of each of the potentially significant environmental impacts associated with the Project and the mitigation measures proposed, indicates that no significant transboundary impacts are expected.

14.4 Environmental Impacts

The residual environmental impact for the Project (i.e. following application of any mitigation) is summarised in Table 14.1.

Table 14.1 Residual environmental impacts

Impact	Key potential impacts assessed	Mitigation identified?	Risk	Significance
Energy use and atmospheric emissions	Emissions resulting from vessel use and use/recycling/replacement of materials	Yes	Minor	Not significant
Discharges to sea	Longer-term release of hydrocarbon from pipeline decommissioned *in situ*	Yes	Negligible	Not significant
Other sea users	Short and longer-term effects on fisheries use of the Project area	Yes	Minor	Not significant
Underwater noise	Vessel use and cutting noise on marine mammals and fish	Yes	Minor	Not significant
Physical presence – seabed disturbance	Effects of disturbance of seabed on habitats and species	Yes	Minor	Not significant
Accidental events	Vessel-vessel collision and loss of inventory	Yes	Minor	Not significant

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Appendix A Environmental Impact Assessment (Norway)

TALISMAN

ENERGY

Decommissioning and disposal of installations on the Rev field

Impact assessment (IA)

17.08.2015

Rev.	Date	Description	Prepared by	Checked by	Approved by
B	17/08/2015	FINAL – Translated EIA	ØS	IG	JMH
A	20/05/2015	FINAL – Norwegian EIA	ØS	IG	JMH
3	02/12/2014	Issued for Approval	RS	HG	JMH
2	13/11/2014	Issued for Partner & Legal comment	EK	HG	JMH
1	23/09/2014	Issued for Review	FB	MB	JMH

Contractor Name/Logo		Purchase Order No.:
Ramboll Oil & Gas		312391
		Contractor Doc. No.: **131614006-ROGN-S-RA-0005**
Facility:	Area:	System:

Document Title:	**Impact assessment (IA)**: Decommissioning and disposal of installations on the Rev field	Doc type: RA
Document No.:	**REV01-24981-Z-RA-0001**	Total Pages: 115

Decommissioning and disposal of installations on the Rev field

Impact assessment (IA)

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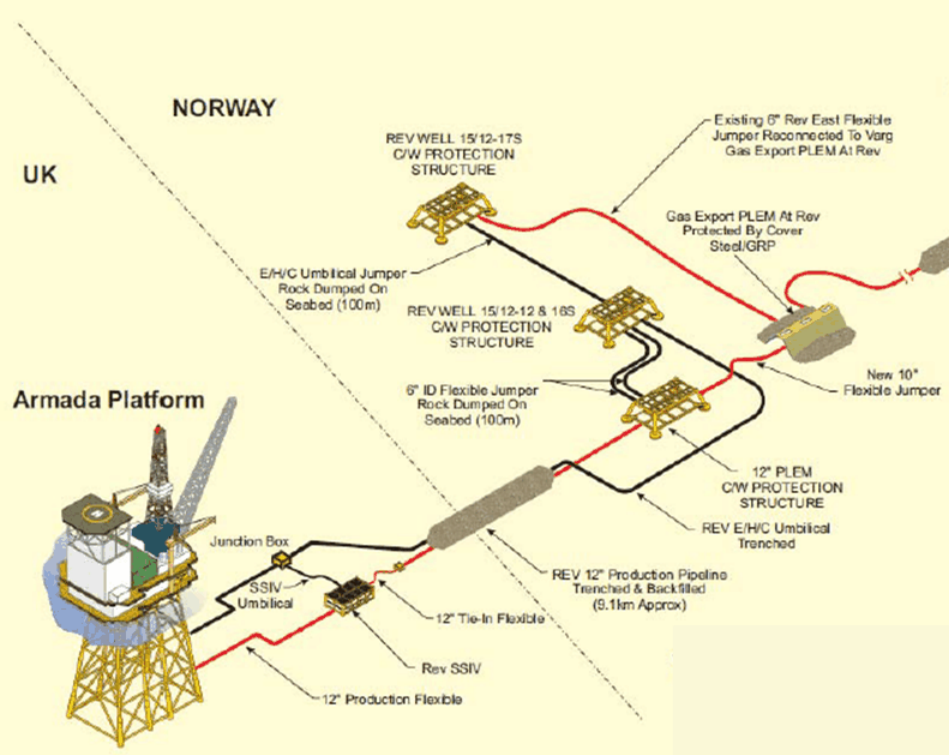
TALISMAN ENERGY

Decommissioning and disposal of installations on the Rev field

Impact assessment (IA)
17.08.2015



Document no.: REV01-24981-Z-RA-0001

Contents

Abbreviations

ALARP	As low as reasonably practicable
AIS	Automatic identification system
ASD	Ministry of Labour and Social Affairs (Arbeids- and sosialdepartementet)
BAT	Best available technology
BG	British Gas
CATS	Central Area Transport System
DECC	Department of Energy and Climate Change
ELS	Everest Liquid System
EPC	Engineering, procurement and construction
FPS	Forties Pipeline System
IMO	International Maritime Organization
IOP	Institute of Petroleum in London
JNCC	Joint Nature Conservation Committee
IA	Impact assessment
LSC	Limit of significant contamination
MERMAN	Marine Environment Monitoring and Assessment National Database
NGL	Natural gas liquids
NPD	Naphthalene, phenanthrene and dibenzothiophene and their C1, C2 and C3 alkyl homologues
OBM	Oil-based mud
OD	Norwegian Petroleum Directorate (Oljedirektoratet)
OED	Ministry of Petroleum and Energy (Olje- og energidepartementet)
OSPAR	Oslo/Paris Convention on the Protection of the Marine Environment of the North East Atlantic
PAH	Polyaromatic hydrocarbons
P&A	Plug and abandonment
PCB	Polychlorinated biphenyls
PLEM	Pipeline end manifold
PLET	Pipeline end termination
Ptil	Petroleum Safety Authority Norway (Petroleumstilsynet)
RIA	Regional impact assessment
ROV	Remotely operated vehicle
ASI	Areas of special importance
THC	Total hydrocarbon
TOM	Total organic material
VGE	Varg gas export system

Foreword

This impact assessment (IA) has been drawn up in accordance with the provisions of the Norwegian Petroleum Act [Petroleumsloven] on the decommissioning and disposal of installations on the Norwegian continental shelf, and on the UK continental shelf. The impact assessment deals with fixed installations and associated infrastructure on the Rev field. The document presents suggested methods, and the chosen solutions will be based on the results of ongoing removal studies.

The Rev installation is covered by production licence 038 held by Talisman Energy Norge AS (Talisman – 70%) and Petoro AS (30%).

The Rev field is located in Block 15/12, roughly 6 km south of the Varg field, close to the border with the UK continental shelf. The field was discovered by Norsk Hydro in 2001. Pertra acquired its share and took over operations in 2002, which were then purchased by Talisman Energy Norge AS in 2005. The plan for development and operation was approved in June 2007. The Government then gave Talisman Energy permission to lay and operate a pipeline from Rev to the Armada installation in the UK sector.

The Rev field started production in 2009. As of the end of Q2 2014, total net production on the Rev field was 0.7 m Sm^3 of oil and 2.6 bn Sm^3 of gas. Production is periodic, and based on an up-to-date production forecast, the expected end-date for production on Rev is no earlier than mid-2015.

The impact assessment is based on the approved analysis programme and was submitted for public consultation in Norway 20.05.2015. Any comments or input on the impact assessment was sent to Talisman, with a copy to the Norwegian Ministry of Petroleum and Energy. A consultation period of 12 weeks was agreed upon with the Ministry.

Stavanger, 17.08.2015.

Summary

Based on periodic production on the Rev field, the rights holders are planning to terminate the operation of the field. Under Norwegian rules, a decommissioning plan for the field has to be drawn up 2-5 years before the production licence expires or the use of an installation ceases. Based on a production forecast and current expected oil and gas prices, production on Rev is expected to end in the near future.

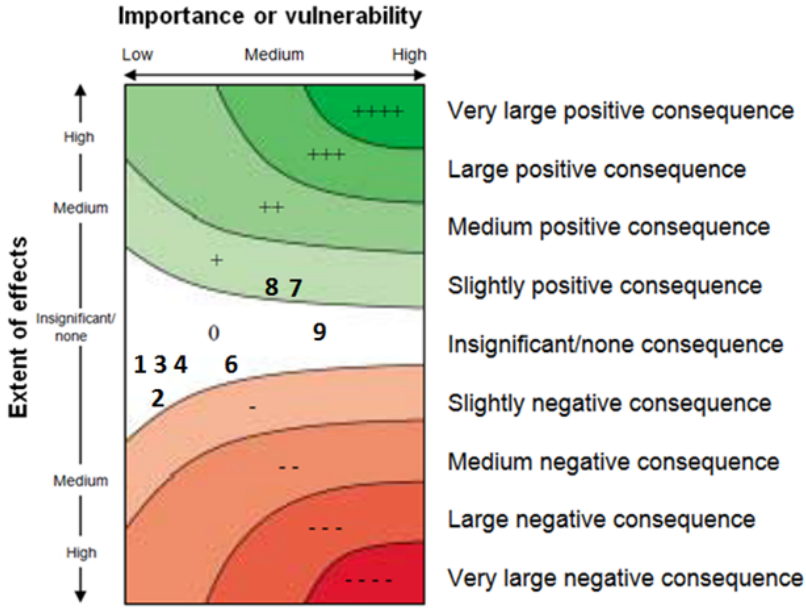
Production on the Rev field started in 2009. Rev is now in the tail-end production phase with reduced reservoir pressure. The field comprises four seabed installations split into two separate areas, Rev West and Rev East. From the Rev field, a nine-kilometre pipeline is routed to the Armada installation on the UK continental shelf, where all processing takes place. Gas from the Varg field is now (2014) transported via the Rev infrastructure and on to the UK.

Drilling has been carried out on Rev with both water and oil-based drilling fluid. Only water-based cuttings have been discharged into the sea, as discharges of oil-based cuttings were prohibited from 1991. The estimated volume of water-based cuttings discharged in the period 2006-2012 is approx. 3,400 tonnes.

Results from environmental monitoring activities show that the sediments around Rev are slightly contaminated with hydrocarbons (THC) (average levels = 2 mg/kg). In general, it is found that the highest concentrations are at the measuring stations 500 metres from the Rev installation. However, these concentrations are below the limits and do not require further investigation. Among the measured metal concentrations, barium stands out somewhat (35–160 mg/kg). It should be noted that, for the shallow sub-region of which Rev is a part, the barium concentrations range from 26 to 936 mg/kg /30/. High barium values mainly result from the use of barite ($BaSO_4$) as a weighting agent in various types of drilling mud. Barium can potentially accumulate in aquatic organisms, but the metal is expected to occur in its original form (from the source barite, $BaSO_4$) or to form other insoluble salts with limited biological activity, so it does not represent a major environmental risk.

Various disposal options for Rev have been evaluated in accordance with the provisions of the Petroleum Act. If no solutions for re-use can be found, it is planned to remove the installations and take them ashore for cutting up, disposal and recycling of the materials. The Rev installations will be handled in accordance with the applicable Norwegian requirements and rules. Large parts of the installations are made of steel which can be cut up and melted down. Wherever possible, hazardous waste will be dealt with and removed before cutting up starts. Materials that cannot be re-used will be recycled, and any remaining waste will be processed in line with normal waste management practice.

The recommended decommissioning solution for the seabed installations is complete removal, which is planned as a single campaign with a lifting vessel. The impact assessments relating to this are presented in Figure 1.



Discharge to the sea	**1**
Impact on the seabed	**2**
Spread of contaminants	**3**
Impact on biota	**4**
Littering	**N/A**
Aesthetic impacts at the reception facility	**6**
Waste management / resource utilisation	**7**
Fishing	**8**
Shipping	**9**

Figure 1. Impact matrix for recommended disposal solution for Rev seabed installations (removal)

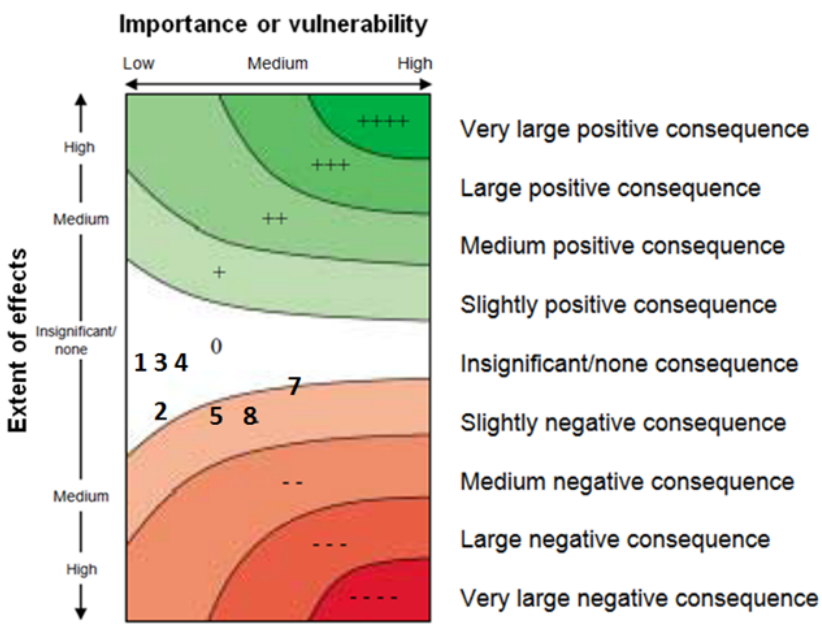
As can be seen from the diagram, the consequences of discharges to the sea, impact on the seabed, spreading of contaminants, effects on biota, and the aesthetic impact of the reception facility are considered to be “insignificant/none”. This is because the impact will be geographically limited and of brief duration, and any emissions and effects on the water column/seabed will be limited in terms of volume and will be restored after a relatively short time. At the reception facility too, the activities will be limited in duration, and the effects of noise, visual disturbances etc. will not be relevant as they are assumed to be covered by the facility’s general operating permit.

For waste management and resource utilisation, the consequences of removing the Rev seabed installations are considered to be “slightly positive”, as it will have a positive effect on employment, and the recycling of waste and metals will be positive in terms of energy compared to producing new energy and new metal. For shipping, the impact of the removal work is rated as “insignificant/none”, as it is expected that the vessels involved will not be a practical hindrance to shipping in the area. The seabed installations are over-trawlable, but removal is nevertheless considered to have a “slightly positive” impact on fishing as it eliminates potential future conflicts with fishing.

For the pipe system connected to the Rev field, the following options have been evaluated:

1. Leaving the entire pipe system *in situ* (base case)
2. Removing the entire pipe system
3. Removing gravel-dumped pipes/cables and leaving buried pipes/control cables *in situ*

Based on the assessments presented in sections 6 to 9, alternative 1 appears to be the most advantageous disposal option. Figure 2 provides an overview of the assessed impact affiliated with this alternative.



Discharge to the sea	1
Impact on the seabed	2
Spread of contaminants	3
Impact on biota	4
Littering	5
Aesthetic impacts at the reception facility	N/A
Waste management / resource utilisation	7
Fishing	8
Shipping	N/A

Figure 2. Impact matrix for leaving the entire pipe system *in situ* (base case)

Leaving pipes and cables *in situ* is considered less technically challenging and so constitutes less of a safety risk than removal (options 2 and 3). There will also be major costs associated with removing the pipes/cables compared to leaving them *in situ* /8/. Moreover, the production pipeline and control cable between Rev and Armada are buried, while the remaining pipes and cables on the Rev field are gravel-dumped, and according to the usual practice on the continental shelf, can normally be disposed of on site. Refer to Storting white paper no 47 (1999-2000), which says that, as a general rule, permission should be given for pipes and cables to be left *in situ* where they do not cause inconvenience or constitute a safety risk for bottom-dwelling fish, compared to the costs of burying, covering or removing them. This means that pipes and cables can be left where there is no such fishing of any significance or where the pipes or cables have been or will be properly buried or covered up. Under UK law, pipes that are adequately buried/entrenched are regarded as candidates for leaving *in situ*. This is subject to an assessment to establish that no exposed sections will develop and that the state of the pipe (adequately buried/entrenched) will persist /6/.

The likelihood of buried pipes and cables between Rev and Armada becoming exposed over time is considered low, as the seabed sediment in the area is made up of compact sand which is not exposed to significant erosion. To prevent snagging of fishing gear, any exposed sections of pipe will be buried and/or rock-dumped, or possibly cut off and taken ashore for final disposal. When the work is finished, an inspection will be conducted to ensure that any pipes left *in situ* are not considered to constitute a hindrance to fishing in the future.

As with the seabed installations, the impact of discharges to the sea, effect on the seabed, effects on biota and spreading of contaminants is considered to be “insignificant/none” for all pipes/cables. For littering, and waste management and resource utilisation, the consequences of leaving the pipelines *in situ* are rated “slightly negative”. The reason for this is that the pipes that are left *in situ*

are defined as litter, and it will require more energy to produce new steel compared to the potential energy used for recycling if they are removed. The total energy consumption and emissions into the air and the marine environment are still lower if the fixtures are left on the seabed than with the other two removal options. Estimated energy consumption (figures also include removal of the Rev seabed installations) from leaving *in situ* (1) are put at just under 60,000 GJ. According to the proposed impact scale from the Norwegian Oil and Gas Association (Norsk Olje & Gass) for energy consumption for offshore decommissioning /22/ the energy consumption is considered to fall within the impact category “insignificant/none”. Estimated emissions of CO_2, NO_x and SO_2 are put at 4,400, 50 and 15 tonnes respectively.

1 Introduction

1.1 Ownership structure

Rev is covered by production licence 038 C in Block 15/12, which is located in the central part of the North Sea. The operator is Talisman Energy Norge AS (TENAS). The rights holders and their shares are shown in Table 1.

Table 1. Rights holders and shares in licence 038 C

Rights holder	Share (%)
Talisman Energy Norge AS	70
Petoro AS	30

The production licence was awarded in June 2006 and runs to September 2021. The original design life of the Rev installation was 10 years, from 2009 to 2019.

1.2 Description of the installation

The Rev field was discovered in 2001 by Norsk Hydro. The find was numbered 15/12-12 and was then known as Varg South. TENAS took over as operator of the Rev field in 2005 and its plan for development and operation was approved in June 2007. The Government then gave TENAS permission to lay and operate a pipeline from Rev to the Armada installation in the UK sector. Production of gas (and oil) started in 2009.

The Rev field is located roughly 6 km south of the Varg field, close to the border with the UK sector, as shown in Figure 3. The Rev field is classed as a gas condensate field and consists of an oil zone topped with a gas cap. The reservoir is in late Jurassic sandstone with a salt structure at a depth of around 3,000 metres. The depth of water in the area generally varies from 90 to 110 metres, while Rev stands in a nominal depth of 85 metres.

The Rev field is located about 10 km north-east of the Armada installation, which is in Block 22/5b on the UK continental shelf, as illustrated in Figure 4. The well stream from Rev passes through a 9.1 km pipeline to the Armada field in the UK sector, where British Gas International Ltd (BG) is the operator. The Armada operator is responsible for operation. Gas and condensate from Rev are processed at the Armada installation and then exported to Seal Sands on Teesside in the UK through the UK's Central Area Transmission System (CATS). The liquid is transported via the Everest Liquid System (ELS) and the Forties Pipeline System (FPS) to the Kinneil processing plant at Grangemouth.

Seven exploratory and four production wells have been drilled on the Rev field. The Rev field now comprises three gas production wells.

Recent measures to prolong the life of the Rev field include exporting reinjected gas in the Varg reservoir to the UK via the existing Rev infrastructure. The new gas export system started production in Q1 2014.

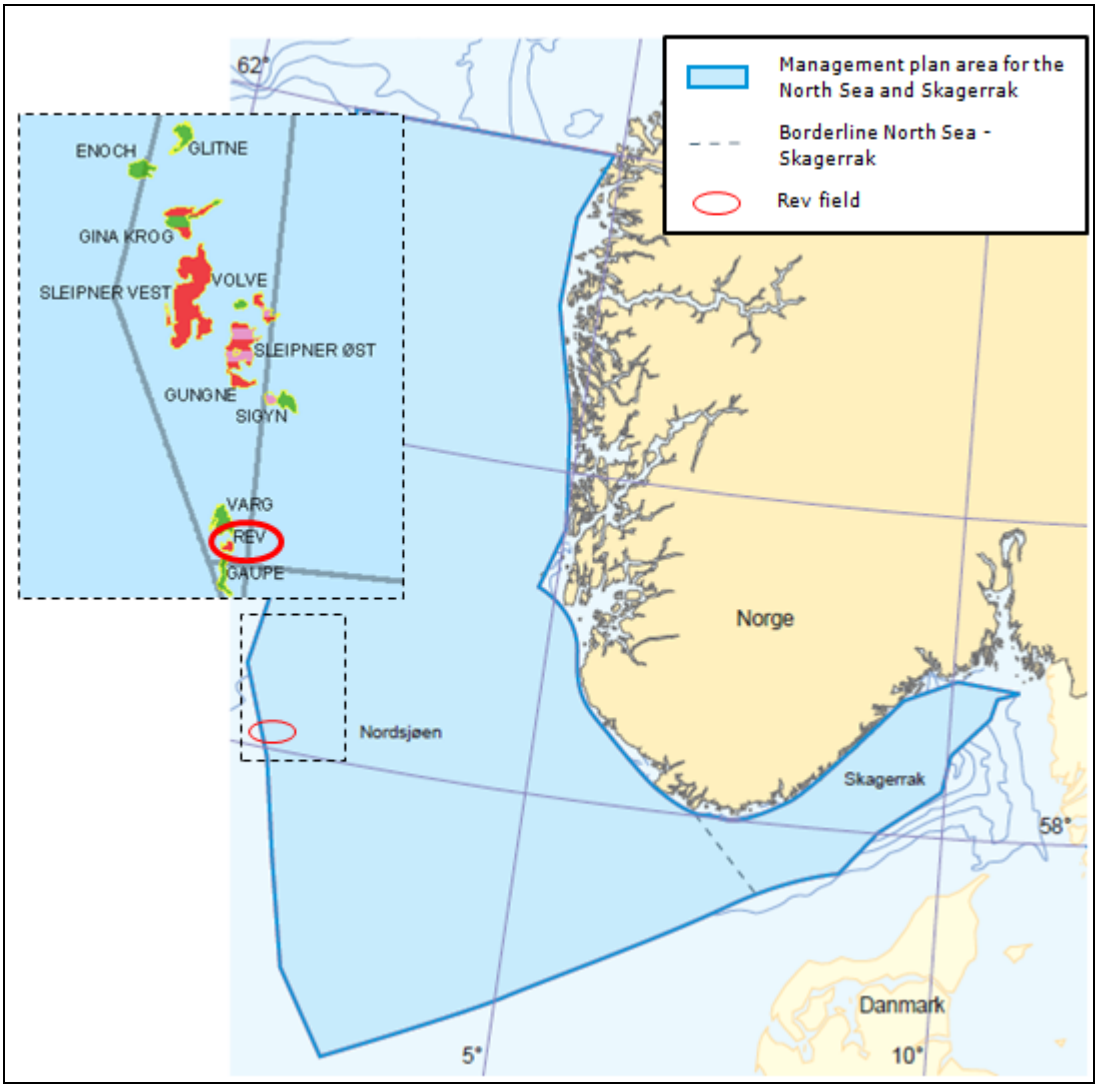


Figure 3. Location of the Rev field in the North Sea

1.2.1 Seabed installations

The Rev field is a seabed facility comprising four seabed installations split into two separate areas, Rev West and Rev East. The original Rev project included two production wells; the third was introduced only later. The first two producers are situated in Rev West, while the third is in Rev East. A gas export PLEM (pipeline end manifold) is now (2014) also connected to the Rev field.

Rev East is connected to the gas export PLEM. Extraction on Rev is by pressure depletion. Figure 4 provides an overview of the seabed installations connected to the Rev field.

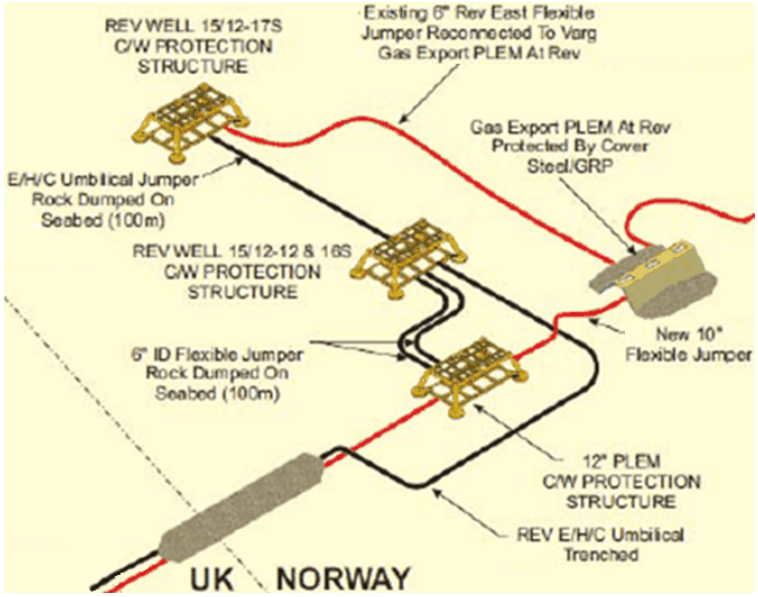


Figure 4. Rev seabed installations

The seabed installations are kept in place by gravel (covers) and weights (concrete mattresses). The protective structure over the seabed installations is mainly of steel and consists of the following sub-components:

- 4 legs
- 4 suction anchors
- 1 protective top unit
- Flowbase (except for Rev PLEM)
- Christmas tree

A simple illustration of the protective structure for the seabed installations is presented in Figure 5.

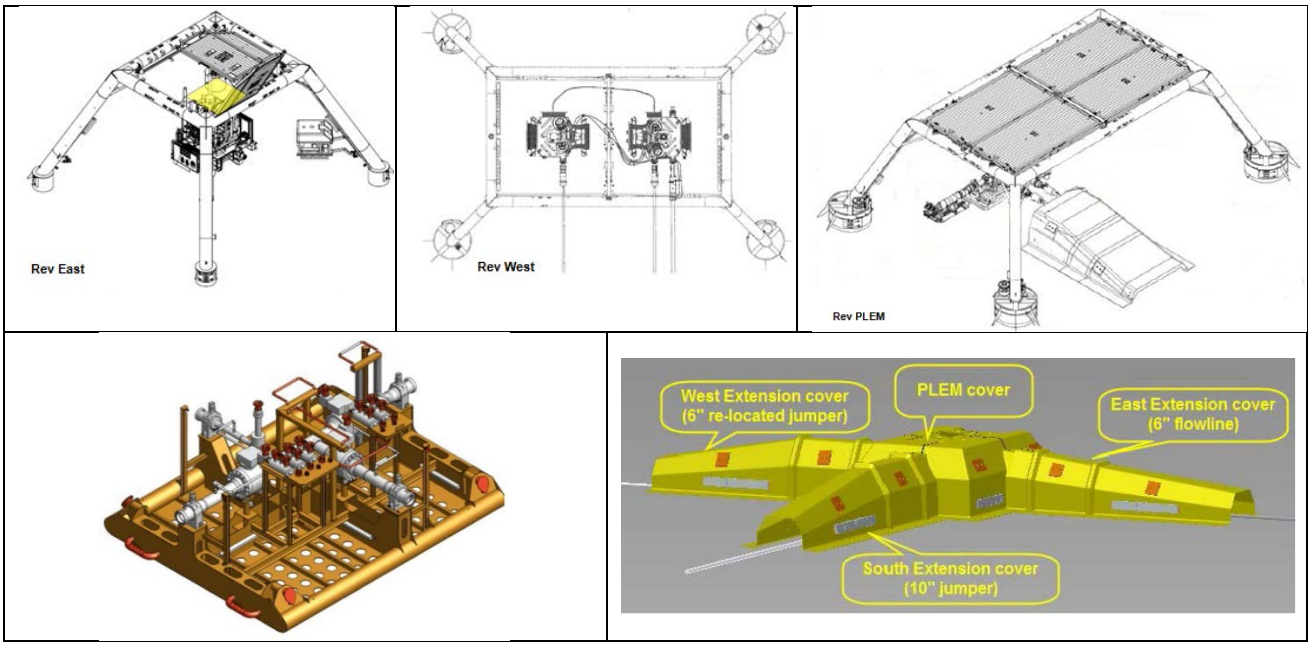


Figure 5. Top: Protective structure for Rev East, Rev West and Rev PLEM. Bottom: Gas export PLEM and associated protective structure

The size of the protective structure and the weight of the Rev installations are shown in Table 2.

Table 2. Dimensions and weight of seabed installations and protective structure

Module	Length (m)	Breadth (m)	Height (m)	Weight (tonnes)
Rev East	20.2	19.2	9.95	54.2
Rev West	34.0	24.0	9.5	69.0
Rev PLEM	19.8	9.15	3.25	31.0
Gas export PLEM	8.9	6.9	3.5	39
Protective structure for gas export PLEM	12.3	10.2	4.2	22.2
Protective structure for eastern extension	15	5	3.3	13
Protective structure for western extension	17	5	3	14.5
Protective structure for southern extension	17	5.5	3.5	14.8
PLEM “dome” protection	8.5	5.4	1.4	3.2
PLEM “dome end” protection (large)	6.6	5.4	1.4	2.6
PLEM “dome end” protection (small)	6.6	5.4	1.4	2.7

Marine growth is a natural phenomenon on installations at sea. No precise calculations have been made of the total weight of marine growth on the seabed installations, but it is expected to be less than 100 tonnes (wet weight) +/- 10%, see Figure 6.

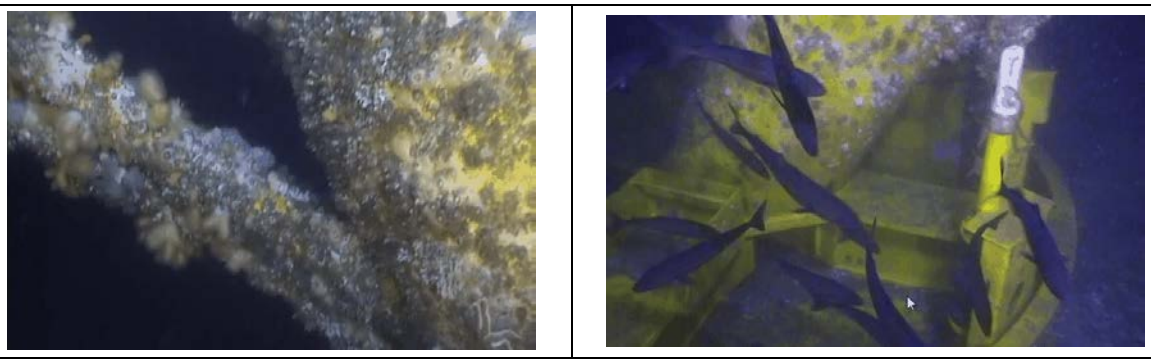


Figure 6. Marine growth on the leg of one of the well frames (left) and suction anchor (right)

1.2.2 Pipelines

As shown in Figure 4, there are three production wells on the Rev field back-coupled to the Rev PLEM via three separate 6″ flexible production flowline jumpers. Between the Rev PLEM and the gas export PLEM there is a 10″ flexible jumper. From the Rev PLEM, a 12” rigid carbon-steel production pipeline is routed to the Armada installation, where all the processing takes place. Between Rev East and Rev West there is an E/H/C umbilical jumper, which passes into an E/H/C control cable (umbilical) routed to the Armada installation after Rev West.

Table 3 presents the different pipelines and control cables connected to the Rev field. The hydraulic control lines and control units in the control cable are closed systems. The injection of production and pipeline chemicals takes place from the Armada installation and is therefore covered by UK regulations. The pipeline from Rev to Armada is 9.1 km long, excluding spools and jumpers, and is routed to the northern part of the NW Seymour drilling centre and linked to the north side of the Armada installation.

Table 3. Pipelines and cables belonging to the Rev field

Pipeline/control cable	Outer diameter (″)	Length (km)	Protection
Production pipeline	12	9.1	Entrenched and back-filled
E/H/C* control cable	6	9.8	Entrenched
ID flexible jumper	6	0.6	Gravel-dumped
2 ID flexible jumpers	9	0.1	Gravel-dumped
E/H/C* control cable	6	0.1	Gravel-dumped
Flexible jumper between gas export PLEM and Rev PLEM	10	0.1	Gravel-dumped

*E/H/C: Electrical/hydraulic control

The production pipeline is entrenched and back-filled to prevent it being exposed on the seabed. Tie-in spools, flexible jumpers and parts of the pipe/control cable are also covered with concrete mattresses and/or gravel-dumped.

Figure 7 shows a simplified view of the infrastructure on the UK and Norwegian continental shelf associated with production from the Rev field. Pipeline and seabed systems to be handled by the rights holders of the Rev field may be summarised as follows:

- 3 well heads including 6″ jumpers to the PLEM (Norwegian sector)
- Rev base frames (PLEM, PLET, gas export PLEM) (Norwegian sector)
- 10″ flexible jumpers between Rev PLEM and gas export PLEM (Norwegian sector)
- 12″ pipeline to flange at the Rev delivery point (Norwegian and UK sectors)
- Rev E/H/C control cable to break-out box, excluding the break-out box itself (Norwegian and UK sectors)

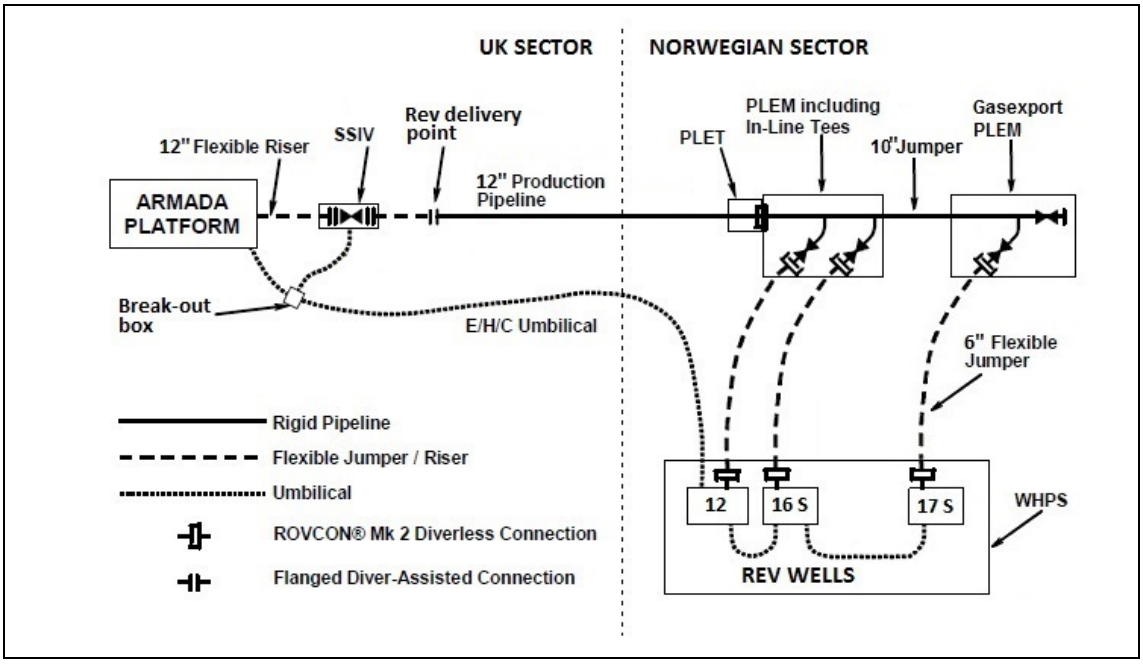


Figure 7. Simplified sketch of the Rev infrastructure

1.2.2.1 Pipe system on the UK continental shelf

As mentioned above, parts of the pipe system are in the UK sector. As illustrated in Figure 7 this includes:

- Approx. 5 km of 12″ pipe
  End-point in relation to the Armada platform is the flange at the Rev delivery point.
- Approx. 5.5 km of Rev E/H/C control cable
  End-point in relation to the Armada platform is the break-out box, excluding the break-out box itself.

1.2.3 Production profile

The 2013 estimates for exploitable oil and gas reservoirs for the Rev field were 0.7 million Sm^3 of oil and 2.7 billion Sm^3 of gas. A total of 0.1 million tonnes of NGL (natural gas liquids) was also projected. Production on Rev started in 2009 and reached a peak as early as 2010, as also shown in Figure 8. Since 2010 production has been decreasing and Rev is now in the run-down phase. The estimated oil and gas production in 2013 amounts to 200 barrels/day and 0.06 billion Sm^3 respectively. Provisional figures (January-July) for 2014 are also shown in the figure.

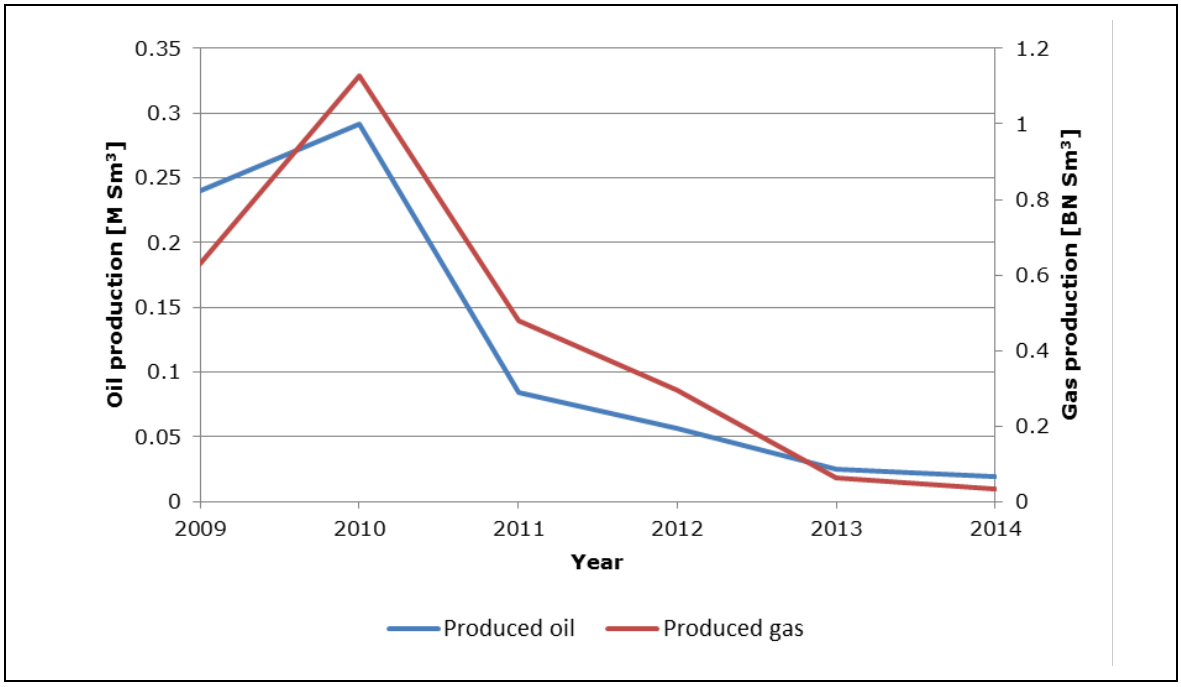


Figure 8. Production profile for Rev

Because of the pressure changes in the field it is expected that production from Rev will cease in the near future; see Figure 8. Since Q1 2014 gas has been transported from the Varg field via the Rev infrastructure and on to the UK. This enables periodic production from the wells on the Rev field. Transport from Varg involves exporting the gas via a six-kilometre pipeline to the Rev field, and then through the existing Rev infrastructure and further export via the Armada field to CATS on the UK continental shelf.

1.3 Objectives and scope of the impact assessment

The rights holders for Rev are planning to cease operation of the field. Under Section 5-1 of the Petroleum Act, a decommissioning plan comprising an impact assessment (IA) and a disposal section must be submitted to the Ministry 2-5 years before the exploitation of Rev is expected to cease for good.

The assessment programme for decommissioning Rev was approved by the Ministry of Petroleum and Energy (OED) on 21.10.2014.

- The purpose of the disposal section is to discuss alternative solutions for disposal and to provide a satisfactory basis for an impact assessment of these alternatives.

- The purpose of this IA is:
  - To ensure that matters related to the environment, natural resources, fisheries and society in general are included in the work, in line with technical, financial and safety concerns
  - To examine issues that are relevant to the internal and external decision-making process, and to provide the public with information on the project
  - To provide for an open and collaborative process, giving different players the chance to express their opinions and to influence the direction of the project.

This IA related to the decommissioning and disposal of the Rev installations presents various disposal options and relevant problems. The approved analysis programme for the IA is the basis the IA will be built on. Responses to consultation on the analysis programme and the operator's related comments are summarised. The IA will attempt to answer the questions raised in the responses to consultation.

1.4 Regulations and requirements

The Rev field is located on the Norwegian continental shelf, and therefore has to comply with Norwegian regulations in addition to international agreements and conventions covering the cessation of operations in the field. Parts of the pipeline are in the UK sector and hence governed by British law.

The basic provisions for decommissioning and removing disused offshore installations are laid down in international agreements and conventions. The most important of these are OSPAR (the Oslo/Paris Convention for the Protection of the Marine Environment of the North-East Atlantic) (decision 98/3) /1/ and the IMO (International Maritime Organization) guidelines (1989) /2/. These lay down requirements for what must be removed and for free passage where installations are only partly removed. The requirements in the treaties are implemented in Norwegian and UK regulations.

OSPAR decision 98/3 does not cover pipelines, and there are no other guidelines covering disused pipelines with international validity. The national guidelines (in this case, the Norwegian and UK rules) will therefore form the basis for an IA and are briefly described below.

Storting white paper [Stortingsmelding] 47 (1999-2000) /3/ addresses the disposal of disused pipelines and cables on the Norwegian continental shelf. According to the white paper, the disposal of pipelines and cables may include further use in the petroleum industry, other use, complete or partial removal or leaving them *in situ*. The choice of disposal option will be mainly assessed with regard to safety, protection of the environment and other uses of the sea, set against the costs, with a view to finding the most socio-economically desirable solution.

Among other things, the section of pipe in the UK sector is covered by rules and requirements set out in the UK Petroleum Act 1998 /4/ and the Pipeline Safety Regulations 1996 /5/, and the guideline from the Department for Energy and Climate Change (DECC) on “Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998” /6/. The approaches in Norwegian and UK law are broadly similar when it comes to disposing of disused pipelines. In addition to a proposed analysis programme and an impact assessment, a detailed comparative assessment also has to be produced for e.g. pipes that are candidates for being left *in situ*. The five main criteria categories are safety, environmental, technical, social and economic.

The Norwegian Petroleum Act contains provisions on impact assessments as part of the basis for decisions when shutting down operations, for example. The requirement for a decommissioning plan is laid down in Section 5-1 of the Norwegian Petroleum Act; it must comprise a disposal section and an IA. The requirement for an IA is laid down in Section 4-2 of the same Act, and in the Regulation to the Petroleum Act, Section 43. Section 44 of the Regulation to the Petroleum Act states what the disposal section should contain, and Section 45 says what the IA should contain. The Act and associated regulations oblige rights holders to report on the impact the measure may have on the environment, natural resources, fisheries and society in general. Possible measures to reduce emissions and prevent damage should be described as part of this work.

The IA process is formally launched by the rights holders producing a proposed analysis programme for public consultation. Comments on the proposal are then sent to the operator (with a copy to the Ministry of Petroleum and Energy), and any suggestions are assessed and forwarded to the Ministry. The Ministry of Petroleum and Energy will decide upon the analysis programme on the basis of this proposal, consultation responses and any comments on these from the operator/licence holders. The analysis programme will form the basis for the IA to be carried out by the rights holders.

The completed IA will be sent out for a separate public consultation, and the comments will feed into the authorities’ handling of the decommissioning plan.

The decommissioning plan comprising the disposal section and the approved IA will be sent to the Ministry of Petroleum and Energy and the Ministry of Labour and Social Affairs, with copies to the Petroleum Safety Authority Norway and the Norwegian Petroleum Directorate. Depending on the projected costs of the project, the decommissioning plan will be discussed by the Norwegian Government or the Parliament [Storting]. As of 2010 the threshold for Storting approval (of development projects) is NOK 10 billion. NOK.

The process for the IA and decommissioning plan is outlined in Figure 9.

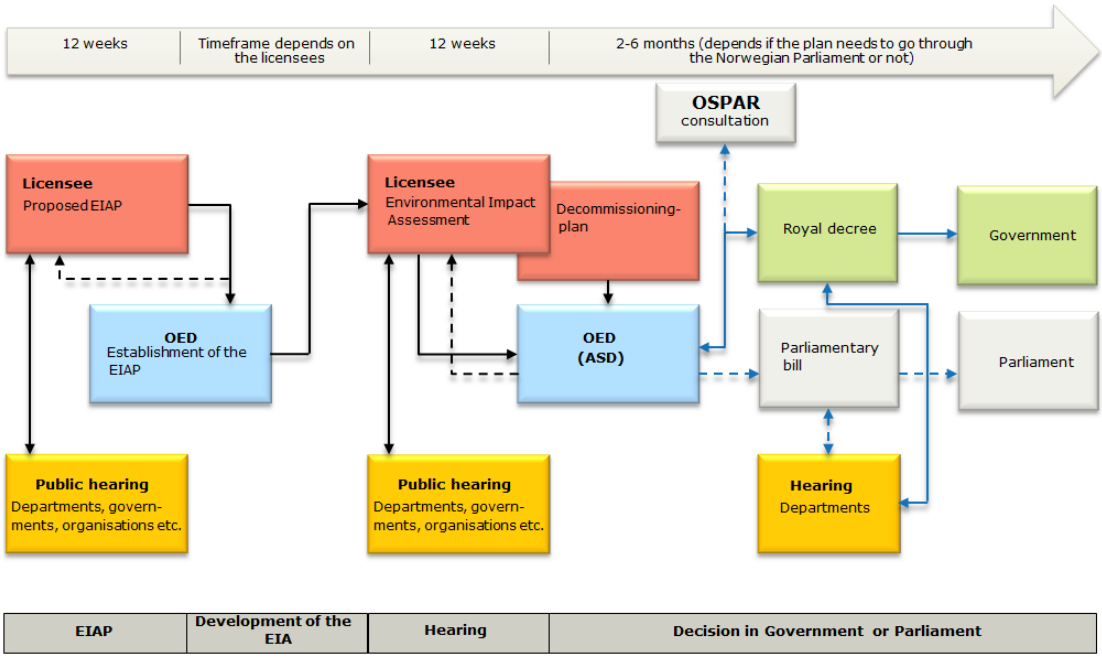


Figure 9. Impact assessment process from the proposed analysis programme to decision by the Government or Parliament

1.5 Timetable for the IA process and handling by the authorities

The formal official requirement normally provides for a decommissioning plan to be produced 2-5 years before the installations are finally shut down, which for Rev means the final cessation of production. Final shutdown of production from Rev is planned for some time after mid-2015. A tentative timetable for the IA and regulatory process up to approval of the decommissioning plan is outlined in Table 4.

Table 4. Timetable for the IA process and handling by the authorities

Activity	Timetable (provisional)
Consultation on the proposed impact assessment programme	12 weeks from January 2014
Definition of the analysis programme	Q4 2014
Production of impact assessment	Q1 – Q4 2014
Submission of impact assessment (part II of the decommissioning plan)	Q4 2014
Consultation on impact assessment	Q4 2014 (12 weeks)
Summarise comments on the impact assessment	Q2 2015
Delivery of disposal section (part I of the decommissioning plan)	2015
Approval of decommissioning plan	2015 – 2016

2 Plans for decommissioning and disposing of installations and pipelines

2.1 Preparations for decommissioning

Prior to the removal operation, there will be an analysis of hazardous materials. Refer to NORSOK standard S-003 /7/. Identifying and quantifying potentially hazardous waste will provide a better basis to enable the “best available technology” (BAT) to be chosen in the decommissioning process. It should be emphasised that the BAT philosophy is the basis for the technical studies that are planned and which will be implemented in the final decommissioning plan.

Hazardous materials will be secured and sent ashore for proper treatment. It should be stressed here that parts of this analysis cannot be performed as there is still production on the field. The remaining analysis will be completed before the start of cutting up operations.

The analysis also includes an inspection of seabed installations and pipelines for possible damage. When the seabed installations have been removed, the area will be examined closely and any scrap will be removed.

2.1.1 Shut-down of production and plugging of wells

The shut-down of production and plugging of the wells are planned in three phases. The first two phases are to carry out final plugging of the wells (P&A), taking approx. 5 months. Final plugging of the wells will be started when a jack-up drilling rig reaches the field. The work will entail plugging the wells permanently by pumping cement down into the formation. The conductor pipes will also be cut and removed 2-5 metres below the seabed. Phase 3 will be carried out by ship, including removal of well heads, Christmas tree and parts of the top transport pipe. This phase is planned to take approx. 2 months.

2.1.2 Seabed installations

Prior to the removal work, there will be a material assessment of the seabed installations. It should be noted, however, that parts of the material assessment cannot be performed before the installations have been removed, in which case an additional material analysis will be carried out before the actual cutting up work starts. Large parts of the work on the seabed installations will therefore take place at the reception facility.

2.1.3 Pipelines and control cables

The pipeline system to the Rev field consists of seven lines.

- Production line (9.1 km)
- 2 control cables (9.8 km and 0.1 km)
- 4 flexible jumpers (0.6 km and 3 x 0.1 km)

All relevant systems will be cleaned in accordance with established procedures for final disposal. The cleaning process will conform to the industry standard, to ensure that the pipes are adequately cleaned. Subsea pipes and control cables will be cleaned by high-speed flushing with sea water equal to three times the volume of the pipes. If the desired degree of cleanness is not achieved, mechanical cleaning methods such as pigging will be examined. Disposal of oily waste from cleaning will be done mainly through the processing plant at FPSO (connected to the Varg field) or Armada. Alternatively, oily waste will be taken ashore for final disposal.

Any discharges resulting from cleaning will be subject to a discharge permit from the Norwegian Environment Agency (Norwegian sector) and DECC (UK sector), and are not covered by this impact assessment.

2.2 Alternatives assessed

According to the provisions in the Norwegian Petroleum Act for decommissioning and disposing of offshore installations, the owners have to evaluate options for further use within the petroleum industry, other use in place, or removal. According to OSPAR decision 98/3 /1/ the Rev installation may be removed if no re-use solutions are identified at the site.

According to Storting white paper no 47/3/, the disposal of pipelines and cables may include further use in the petroleum industry, other use, complete or partial removal or leaving them *in situ*. Any assessment of the disposal options should be based on environmental considerations and other uses of the sea, taking account of costs and socio-economic factors. The safety risk to staff who are to carry out the removal work must also be included in the calculation; this will be discussed further in the disposal section of the decommissioning plan.

A comparative analysis of the various removal options has been performed for the different solutions based on criteria such as health and safety, the environment, cost, regulations, social aspects and technical feasibility /8/. Alternative decommissioning solutions also considered for the Rev installations are briefly described in the following sections. The assessment of the relevant alternatives is presented from section 6 and onwards.

2.2.1 Seabed installations

2.2.1.1 Re-use or sale of Rev seabed installations

The original design life of the Rev installation was from 2009 to 2019. The sale or re-use of seabed installations is not usually regarded as very relevant. As part of the preparations for shutting down the Rev field, options for selling or re-using the seabed installations were evaluated. Various possibilities for further use were assessed mainly on the basis of age and the technical condition of the installations compared to costs and resources. No realistic options for selling or re-using the seabed installations belonging to Rev have been identified at this time.

2.2.1.2 Removal

If no solutions for sale or re-use can be identified, the seabed installations will be removed with the aid of a suitable floating crane. This means that the installations will be freed from pipes and gravel, lifted and removed from the seabed in one lift per installation. The units will then be taken ashore for cutting up at a suitable reception facility. Any hazardous waste will be removed before the actual cutting up work starts. It is not expected that there will be any radioactive substances in the seabed installations. The seabed installations will then be cut up into smaller pieces and sorted into different waste fractions. Materials that cannot be re-used will be recycled, and any remaining waste will be processed in line with normal waste management practice.

Marine growth will generally accompany the installations ashore and will be removed from the structures at the reception facility. The growth will be delivered to an approved recipient. Some growth may be removed or scraped off during the cutting and lifting work, but the amounts will be limited.

2.2.2 **Pipes and control cables**

For the buried/entrenched/gravel-dumped pipes, removal or leaving *in situ* are being considered. This means that, for the pipe systems connected to the Rev field, the following options will be evaluated:

1. Leaving the entire pipe system *in situ* (base case)
2. Removing the entire pipe system
3. Removing gravel-dumped pipes/cables and leaving buried pipes/control cables *in situ*

2.2.2.1 Leaving the entire pipe system in situ (1)

The production pipeline from Rev to Armada (9.1 km) is buried 1.8 metres beneath the seabed. The control cable from Rev to Armada (9.8 km) is entrenched at a depth of 1.5 metres with natural back-fill. The remaining jumpers and control cables are gravel-dumped.

Before being left *in situ*, the pipe system will be adequately cleaned in accordance with the ALARP principle; see section 2.1.3 for more details. Exposed pipe ends will be buried and rock-dumped if necessary, or removed together with the base frame. Any exposed sections will be secured (removed/covered). The entrenched control cable will be checked to see whether natural back-filling is sufficient.

2.2.2.2 Removal of the entire pipe system (2)

This removal option involves removing the buried production pipeline (9.1 km), the entrenched control cable (9.8 km) and gravel-dumped control cables and jumpers. Prior to any removal operation, the pipeline will be uncovered with the aid of e.g. dredging equipment installed on an underwater digger. The actual removal of the pipe from the seabed will probably entail reverse coiling in cut-up lengths onto the deck of a suitable vessel.

2.2.2.3 Removing gravel-dumped pipes/control cables and leaving buried pipes/control cables in situ (3)

This option involves removing gravel-dumped pipes (including control cables and jumpers on the Rev field) and leaving the buried production pipeline and entrenched control cable that extend from the Rev field to the Armada field in the UK sector. The descriptions given in sections 2.2.2.1 and 2.2.2.2 in relation to the different pipes/cables will also apply to this option.

2.3 Recommended decommissioning option (base case)

The recommended decommissioning option (base case) is based on preliminary studies (including a comparative analysis) /8/ and industry solutions. Further studies will also be undertaken into the various alternatives. The final disposal solution will be based on method studies.

2.3.1 Seabed installations

The seabed installations connected to the Rev field are suitable for removal and are considered relatively easy to remove by conventional methods. No realistic options for re-use have been identified at this time. The owners' recommendation is therefore that the Rev installations should be removed and taken ashore to be cut up, followed by re-use, recycling and eventual disposal of the materials. It should be emphasised that, wherever practically possible, the choice of solutions will be based on a BAT philosophy. The work will also be carried out in accordance with NORSOK S-003 /7/ and additional requirements specified in "TENAS Technical requirements – Environmental Care".

It is planned to remove all base structures and structures on the seabed. The seabed installations on the Rev field, including Rev East, Rev West, Rev PLEM and the gas export PLEM, are expected to be freed from the seabed before being removed. The removal operation will then be carried out with the aid of a suitable vessel. The seabed installations have a total weight of around 290 tonnes, including protective structure (see section 1.2.1). Parts of the legs of the seabed installations are covered with gravel, so some dredging work will be required prior to the removal operation.

2.3.2 Pipes and control cables

No options for re-use have been identified for the pipe system connected to the Rev field, so it is planned to leave this *in situ*.

The production pipeline (9.1 km) and control cable (9.8 km) from Rev to Armada are buried and entrenched with natural back-fill respectively and, in keeping with the usual practice on the continental shelf, can be left *in situ*. Leaving the production pipeline and control cable *in situ* means cutting them off at the Rev PLET and well-head no 12 respectively. In the UK sector the production pipeline and control cable will be cut off at the flange at the Rev delivery point and at the break-out box, excluding the break-out box itself (see section 1.2.2).

Jumpers and control cables (0.1 km) connected to the well-heads on the Rev field are gravel-dumped and/or covered with concrete mattresses (see Figure 10) and, according to the usual

practice on the continental shelf, can normally disposed of on site. The pipes will be disconnected from the PLET and PLEM (belonging to the Rev field) and left *in situ*. The technical state of the concrete mattresses will be crucial to their final disposal. It is basically planned to remove these by lifting them by their attachments and placing them on the vessel. If some of the concrete mattresses turn out to have a stabilising effect on buried pipes that are to be left in place, these concrete mattresses may also be left in place.

Routes of pipes and cables have been surveyed in their entirety (from Rev to Armada) at fixed intervals since they were installed. The last inspection confirmed that the pipes and cables are securely buried, with only a few sections of control cable displaying a tendency towards exposure /9/. To prevent snagging of fishing gear, any exposed or suspended sections of pipe will be buried and/or rock-dumped, or possibly cut off and taken ashore for final disposal. The pipe end pieces will either be buried and covered over or removed together with the base frame. When the decommissioning work is finished, an inspection will be conducted to ensure that any pipes *left in situ* are not considered to constitute a hindrance to fishing in the future.

Figure 10. Jumpers covered with concrete mattresses (left) and jumpers fixed to well 15/12-16 S (right)

2.4 Relevant reception / cutting facilities

The Norwegian Environment Agency (formerly Klif) recommends in its report on decommissioning offshore installations that efforts should be made to limit the environmental impact and costs of waste handling /11/. It is important to support future planning for decommissioning the fields by insisting that the operators ensure that any documentation that may have a bearing on the decommissioning is retained; e.g. inventory lists and construction drawings.

The Rev installations and associated infrastructure will be cut up under controlled conditions on shore at a suitable/licensed location/facility with an approved concession. There are currently four facilities licensed to receive and process disused offshore equipment; all four are located in the west and south-west of Norway. Table 5 provides an overview of the reception facilities that are considered relevant for cutting up the Rev installations, with alternative reception facilities abroad.

Table 5. Relevant locations for cutting up the Rev installations /11/

Reception facility	**Location**	**Comments**
Lutelandet Offshore AS	Lutelandet (Sogn og Fjordane)	When the facility here is completed, it will have a dry dock which will be one of the largest in the world, at 21 metres deep /12/.
Kværner	Stord (Hordaland)	The quay has 19 metres of water. /13/, /14/, /15/.
AF Decom Offshore AS, Miljøbase Vats	Vatsfjorden (Rogaland)	The main quay is 182 metres long and has 23 metres of water. The Vats base has 68,000 m^2 of solid decking with a membrane beneath /16/.
Scandinavia Metall AS (Scanmet AS)	Hordaland	Scanmet AS was acquired by Bergen Group in 2014 and is set to relocate the facility and re-establish itself in Bergen /17/.
Alternative reception facilities abroad	**Location**	**Comments**
Able UK TERRC	Teesside (England)	The dry dock here is one of the largest in the world. 376 metres long and 233 metres wide. Has a depth of 12.15 metres /18/.
SBS Peterson	Greenhead base, Lerwick (Shetland)	The area currently covers 20,000m^2 – planned to grow to 50,000m^2. Depth 9 metres /19/.
AF Decom	Dales Voe, Lerwick (Shetland)	Large base (25,000m^2) dock with 12.5 metres of water /20/.

AF Decom's facility in Vats has the most recent permit and the strictest requirements. Vats has a permit covering the acceptance and processing of disused marine constructions, with permission to store up to 50,000 tonnes of waste at the facility. They can also store up to 500 tonnes of scrapped EE products and up to 300 tonnes of hazardous waste. The facility also has a permit from the Norwegian Radiation Protection Authority to store radioactive waste from scrapping offshore installations.

Until 2014, Kværner Stord and Scandinavia Metall were co-located and worked together to receive and cut up offshore installations. Both facilities have a licence to accept disused offshore installations. They do not take in hazardous waste but deliver this to Sunnhordland Interkommunale Miljøverk (SIM Næring AS) which is in the same area. The facilities are not authorised to process and store radioactive waste today. In 2014, Scandinavia Metall was purchased by the Bergen Group and will move its operations from Stord to Bergen. Lutelandet Offshore is planning a major expansion and will acquire a dry dock 21 metres deep.

The Norwegian Environment Agency has been auditing the discharge permits for all of these yards since 2012, and all have been and will be set stricter discharge limits for water, and requirements for measures to reduce diffuse dispersal of contaminants into the air and water. Strict requirements will be set for accepting, storing and processing waste, as well as noise standards. There will also be requirements for measuring programmes for the discharges and programmes to monitor the effects of the emissions into the environment.

2.5 Final disposal

In projects to decommission and dispose of disused offshore petroleum installations, waste management is based on the principles behind the waste hierarchy (see Figure 11). This is why significant efforts have been made to optimise disposal solutions for the various waste flows in order to achieve the best environmental solution based on a BAT philosophy.

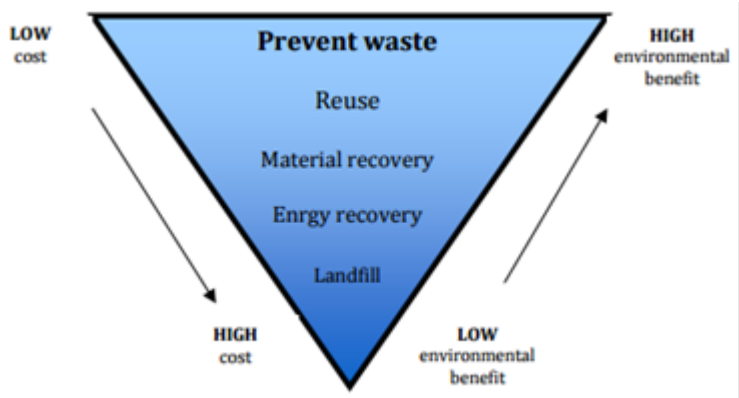


Figure 11. The waste triangle /21/

In the first instance, an attempt will be made to re-use materials from seabed installations and associated infrastructure. Based on experience from earlier shut-down projects, however, the potential for re-use is expected to be limited, so it is reasonable to assume that it will be taken ashore to be cut up.

Most of the seabed installations are made of normal steel which can be cut up and melted down. The pipes are mainly of steel and various plastic materials. At the reception facility the Rev structures will be processed in line with the general requirements and regulations. This means that the structure will be inspected for the presence of environmentally hazardous substances (such as heavy metals, radioactive materials or hydrocarbons). Any finds will be processed according to the facility's procedures and licence conditions, and removed before the actual scrapping work starts /7/. The steel structures will then be cut up into manageable sizes and sent directly to an approved smelting or metalworking plant. Based on experience from other projects, it is estimated that some 96-98% of the materials can be recycled.

The following materials are expected to come from the Rev installation:

- Carbon steel

- Rust-resistant steel alloy
- Copper
- Aluminium
- Titanium
- Copper-nickel alloys
- Zinc (zinc-aluminium anodes)
- Plastic

2.6 Timetable

Earliest shut-down date is 2015. A provisional timetable for the decommissioning work is shown in Table 6.

Table 6. Provisional timetable for various decommissioning activities

Activity	Timetable (provisional)
Shut-down of production	Mai 2015
Plugging of wells (phase 1 and 2)	May-August 2015
Plugging of wells (phase 3)	May-August 2015
Preparations for removal	2017-2018
Marine operations (removal of seabed installations, various seabed equipment, cutting of pipes, gravel-dumping/burying pipe ends etc.)	2018-2019
Final disposal	2020

2.7 Necessary applications and permits

Table 7 provides an overview of possible applications and permits to be obtained from Norwegian authorities

Table 7. Indicative list of applications and permits required to shut down Rev

Application/permit	Applicable law	Responsible authority
Decommissioning plan, incl. IA	Petroleum Act	OED / AD
Application for an discharge permit in connection with emptying pipes	Pollution Act	Norwegian Environment Agency (Miljødirektoratet)
Application for a permit for dredging/removal of sediment/drill cuttings	Pollution Act Pollution Regulation	Norwegian Environment Agency (Miljødirektoratet)
Application for consent to dispose of installations	Control Regulation, Section 25d	Petroleum Safety Authority Norway

3 Summary of responses to the draft programme

A draft impact assessment programme for decommissioning of the Rev installation was sent for consultation to 36 bodies in Norway, with a deadline for responses of 21.10.2014. The responses to consultation received are summarised in Table 8. The draft programme was also translated in English and sent to the Department for Energy and Climate Change (DECC).

Table 8. Summary of consultation responses to the programme for an impact assessment, with operator's reply

Body consulted and statements made	Talisman's assessment
1. Norwegian Ministry of Climate and Environment (Ref: 14/565-)	
1. The Ministry of Climate and Environment notes that the requirement to use BAT (best available techniques) also applies to the choice and implementation of solutions for decommissioning and disposing of installations.	1. The IA will focus on examining possible consequences of the relevant disposal solutions, including the use of BAT.
2. There needs to be a thorough analysis of possible radioactive substances in deposits and other contaminants in the installations before any solutions and methods are chosen.	2. There will be an analysis of possible radioactive substances and other contaminants both in the planning phase and after production has ceased.
3. The consequences of covering any exposed sections of pipe must be covered by the IA.	3. The consequences of covering any exposed sections of pipe will be covered by the IA.
4. The Norwegian Petroleum Museum should be consulted to determine whether there is a need for any historic monument documentation as part of the decommissioning.	4. Talisman notes that Rev has been assigned priority D in the historic monuments plan. The Norwegian Petroleum Museum will have access to the desired documentation to the extent that it is considered possible to supply it to the museum. Talisman will contact the Norwegian Petroleum Museum.
5. We also note that there have to be two monitoring exercises three years apart after operations have been wound up.	5. Talisman will contact the Norwegian Petroleum Museum.
6. The Ministry of Climate and Environment also refers to responses from the Norwegian Environment Agency, the Directorate for Cultural Heritage and the Norwegian Radiation Protection Authority, which we endorse. We have no further comments on the proposal	6. Comments noted.
2. Norwegian Environment Agency (Ref: 2013/7390)	
1. The Norwegian Environment Agency refers to the Regulation to the Petroleum Act, Section 45, which states that, when offshore installations are	1. Talisman confirms that an IA will be drawn up with the various disposal options for Rev.

decommissioned, an IA must be produced containing a description of the possible impact of each of the disposal options on industry and the environment, and what can be done to reduce discharges associated with disposal and to prevent any damage or nuisance.	
2. With regard to pipes, we would point out that TENAS must ensure that any exposed sections are covered up. We would also point out that, according to the *Guidelines for environmental monitoring of petroleum operations on the Norwegian continental shelf*, TENAS must carry out two further monitoring surveys three years apart after the operations have been wound up. TENAS must deal with exposed sections and future monitoring in the IA.	2. Re: replies 3 and 5 from the Ministry of Climate and Environment
3. We would also observe that TENAS has to apply for a permit under the Pollution Act for any activities associated with decommissioning that could cause pollution. This applies to emissions into the air and/or sea, and dredging.	3. Permits for any activities associated with decommissioning that could cause pollution of the external environment will be applied for in accordance with the Pollution Act.
4. Apart from our comments, the Norwegian Environment Agency believes that TENAS's draft assessment programme covers the areas it is important for an IA to cover with regard to the external environment; cf. Petroleum Regulation, Section 45.	4. Comments noted.
3. Norwegian Fishermen's Association (Ref: 2014/00094-2)	
1. The Norwegian Fishermen's Association assumes that the wells that have already been decommissioned and plugged have been plugged as "finally" decommissioned and not just temporarily, so that when the field is definitively would up and cleared, there will be nothing that could impede fishing.	1. The wells will be permanently plugged and closed in such a way that there will be no obstacle to fishing.
2. The Norwegian Fishermen's Association asks that, when it comes to pipelines, solutions involving complete removal should be considered, even though it is established practice for these to be often left in place. If complete removal is not felt to be an option, this should be documented in the IA.	2. Talisman will leave the area in a state that raises the minimum problems for fishing, either by complete removal, rock-dumping or leaving buried pipes *in situ*. The impact of the various options will be assessed in the IA.
3. The Norwegian Fishermen's Association has no other comments on the draft programme, and awaits the impact assessment.	3. Comments noted.
4. Directorate for Cultural Heritage (Ref: 14/00417-3)	

1. In 2005, the Norwegian Petroleum Museum was tasked by the Ministry of Petroleum and Energy, the Norwegian Petroleum Directorate (OD) and the Norwegian Oil Industry Association (OLF) with drawing up a historic monuments plan for the petroleum sector. The project has received technical assistance from the Directorate for Cultural Heritage, and has worked closely with representatives from OD, OLF and the major oil companies. This work was completed in 2010 as a “Historic monuments plan for the petroleum sector on the Norwegian continental shelf” – both in book form and as an electronic edition on the Norwegian Petroleum Museum website, later revised in 2012. The historic monuments from petroleum operations in the North Sea represent essential sources for the history of Norwegian society. Historic monuments of national importance should be preserved as sources of knowledge, and the historic monuments plan should contribute to greater awareness and understanding of conservation at the national and local level, while providing predictability and quality in work on future historic monuments – particularly in connection with decommissioning plans for the oil and gas fields. The result of the work on the historic monuments plan is a priority list of fields which represent the joint assessment of the industry, the professional authorities and the Directorate for Cultural Heritage of the industrial installations on the Norwegian continental shelf which should be defined as the most interesting historic monuments from the petroleum industry. The priority list has been produced by evaluating the relationship between the history, the overview of offshore installations and the selection criteria used to assess historical importance – with A as the highest and D as the lowest priority. The priority list will be an important tool in the work of initiating and defining new documentation projects for fields and installations on the Norwegian continental shelf. The Rev field was assigned priority D. As part of the impact assessment, the Norwegian Petroleum Museum should be consulted to agree on the extent to which historic monument documentation should	1. Ref. reply 4 from the Ministry of Climate and Environment

be produced as part of decommissioning the Rev field.	
2. Finally, we would emphasise that a satisfactory analysis of any ship finds in connection with decommissioning facilities used to extract oil and gas presupposes good procedures for reporting between the historic monuments administration and the oil industry. It is most helpful for those responsible for these measures to coordinate any surveys with the historic monuments administration, to avoid duplication. The earlier the historic monuments administration is involved in this work, the sooner any conflicts with underwater historic monuments can be detected and avoided. This is also by far the best solution from a cost standpoint.	2. Comments noted.
3. The Directorate for Cultural Heritage also points out that finders of ship finds are obliged to report them to the relevant authority; cf. Cultural Heritage Act, Section 14 third paragraph.	3. Comments noted.
5. Norwegian Radiation Protection Authority (Ref: 14/00178/425.1)	
1. The Norwegian Radiation Protection Authority's general impression is that the draft impact assessment for decommissioning and disposing of installations on the Rev field basically contains the elements that we would expect to see discussed in the impact assessment. The Authority would point out, however, that it is important to carry out a thorough analysis of any incidence of radioactive substances in the form of deposits or other types of contaminants before the work of dismantling the installations offshore, transporting and cutting them up on land starts and that necessary measures to protect the environment and people are taken in connection with the work. We would also point out that emissions of radioactive substances arising from cleaning work on board require a separate permit. The Norwegian Radiation Protection Authority also wishes to point out that the requirement to use BAT (best available techniques) also applies to the choice of solutions for decommissioning and disposing of the installations on the Rev field, and work to be carried out in connection with this.	1. Re: replies 1 and 2 from the Ministry of Climate and Environment
2. Chapter 5 on planned studies states that, as part of the analysis, a material analysis inspection will be carried out. This will establish an overview of	2. Re: replies 1 and 2 from the Ministry of Climate and Environment

environmentally harmful materials and substances, including radioactive substances, and will explain how these will be dealt with through the decommissioning work. In this connection, the Norwegian Radiation Protection Authority wishes to point out that process equipment and pipes may hold deposits containing radioactive substances, and that any incidence of such substances must be addressed when cleaning installations on the field after shut-down and when planning the handling of cleaning water and disposal of waste. We would also point out that the existing permit for emissions of radioactive substances from the Rev field applies to the operational phase, and that any discharges arising from cleaning work on the installation after production has ceased will require a separate permit.	
3. The draft impact assessment states that facilities on shore for cutting up and material handling will not be confirmed when the impact assessment is carried out. In the impact assessment, Talisman Energy Norge AS will therefore examine the relevant problems based on knowledge of Rev and its components, and on general assessments of relevant scrapping facilities, but will not relate these to actual scrapping facilities. In this connection, the Norwegian Radiation Protection Authority notes that it is important to carry out a thorough analysis of any incidence of radioactive deposits or other radioactive substances in the various parts of the installation before cutting up starts, and that account must be taken of any finds of such substances during the planning and implementation of the work.	3. Talisman confirms that the facilities that are to handle the cutting up on shore will have the necessary approvals and discharge permits from the authorities, including a permit from the Norwegian Radiation Protection Authority for emissions of radioactive contaminants and handling of radioactive waste in accordance with the Pollution Act.
4. The Norwegian Radiation Protection Authority also wishes to point out that any pollution from the operation is undesirable, and that the operator is required to reduce emissions as far as possible without unreasonable costs or risks to safety. It is important that the requirement to use BAT (best available techniques) should also be observed in the choice of solutions for decommissioning and disposing of the installations on the Rev field, and work to be carried out in connection with this.	4. Re: reply 1 from the Ministry of Climate and Environment
Comments noted.	
6. Norwegian Petroleum Directorate (Oljedirektoratet)	No comment.

No comments made.	
7. Ministry of Labour and Social Affairs (Arbeids- and sosialdepartementet)	**8. Directorate of the Norwegian Labour Inspection Authority (Arbeidstilsynet)**
9. Industrial and Energy Workers' Union (Fagforbundet Industri Energi)	**10. Norwegian Fishing Vessel Owners Association (Fiskebåt)**
11. Norwegian Directorate of Fisheries (Fiskeridirektoratet)	**12. Ministry of Defence (Forsvarsdepartementet)**
13. County Governor of Hordaland	**14. County Governor of Rogaland**
15. County Governor of in Vest Agder	**16. Greenpeace Norway**
17. Norwegian Institute of Marine Research (Havforskningsinstituttet)	**18. Board of Health Supervision in Rogaland**
19. Ministry of Local Government and Modernisation (Kommunal- og moderniseringsdepartementet)	**20. Norwegian Coastal Administration (Kystverket)**
21. Trade Union Federation Rogaland (LO Rogaland)	**22. Bellona Foundation (Miljøstiftelsen Bellona)**
23. "Nature and Youth" (Natur og Ungdom)	**24. Green Warriors of Norway (Norges Miljøvernforbund)**
25. Friends of the Earth Norway (Norges Naturvernforbund)	**26. Norwegian Institute for Urban and Regional Research (Norsk institutt for by- and regionsforskning)**
27. Norwegian Petroleum Museum (Norsk Oljemuseum)	**28. Norwegian Oil and Gas Association (Norsk Olje og Gass)**
29. Norwegian Ornithological society (Norsk Ornitologisk Forening)	**30. Norwegian Polar Institute (Norsk Polarinstitutt)**
31. Ministry of Trade, Industry and Fisheries (Nærings- og fiskeridepartementet)	**32. (Copy to) Ministry of Petroleum and Energy**
33. Petroleum Safety Authority Norway (Petroleumstilsynet)	**34. Rogaland county administration**
35. Trawlermen's association of southern Norway (Sør-Norges Trålarlag)	**36. WWF Norway**

4 Methods used in the study

The impact assessment for decommissioning operations on the Rev field follows the principles with regard to structure, content/topics and methodology set out in the Norwegian Oil and Gas Association (formerly OLF) handbook on impact assessments for offshore decommissioning /22/. The methodology has since been supplemented with a descriptive classification system; see section 4.2. Where possible, the methodology covers the quantification of effects on the environment, fishing and society. Any aspects that cannot be quantified are described by way of a technical assessment of the type of effect, scope and impact.

4.1 Method for describing the existing situation

The description of the existing situation in the area around the Rev installation is based on existing literature and data from public institutions and authorities. The facts set out in the “Regional impact assessment for the North Sea” /23/,/24/, and the “Management plan for the North Sea and the Skagerrak” /25/ will be mainly used as a basis for describing the natural resources in the area concerned. Reports on fish stocks, fisheries and fishing activities /26/, /27/, a status report on shipping /28/ and an area report for the North Sea and Skagerrak /29/ were also used. To describe the environmental status within the Rev field, the latest monitoring results from Region II will be taken into account in the assessment /30/. The description of the existing situation therefore forms the basis for the subsequent assessment of the environmental impact. For the pipeline that extends into the UK sector, the environmental aspects have been assessed using available information from various phases of development of the Armada project, from the initial seismic studies to the expansion of the field /31/, /32/ and /33/, and available databases such as the “Marine Environment Monitoring and Assessment National Database” (MERMAN) /34/. Scottish authorities were also contacted /35/, /36/, as was the Joint Nature Conservation Committee (JNCC) /37/.

4.2 Method of assessing, presenting and displaying impact analysis results

To separate major impacts from less important effects, this process included a systematic evaluation of the importance or sensitivity of an area/resource. This should also be viewed in relation to the type of impact the area/resource is exposed to, and the extent of the effect. In this IA, the terms defined/used in the methodology from the Norwegian Oil and Gas Association’s handbook (see Figure 12) have been used in combination with an exhaustive description of the relevant effect classifications, as presented in sections 4.2.2 and 4.2.3.

The method differentiates the impact of an activity according to how important or vulnerable the various areas are, and classifies it according to nature, type, reversibility, intensity, geographical extent and duration. Every impact reported is thus derived from a function between the factors given in Figure 12, Table 10 and Table 11. The impact results for the environment and society have been discussed and evaluated in relation to these methods and entered in a tabular matrix. This matrix then shows which assessments form the basis for the final impact for a given topic/problem, which can then be displayed using Figure 12.

4.2.1 Assessment of importance and/or vulnerability

The terms used in the Norwegian Oil and Gas Association's matrix (see Figure 12) have been used as a basis for the actual impact analysis in the IA.

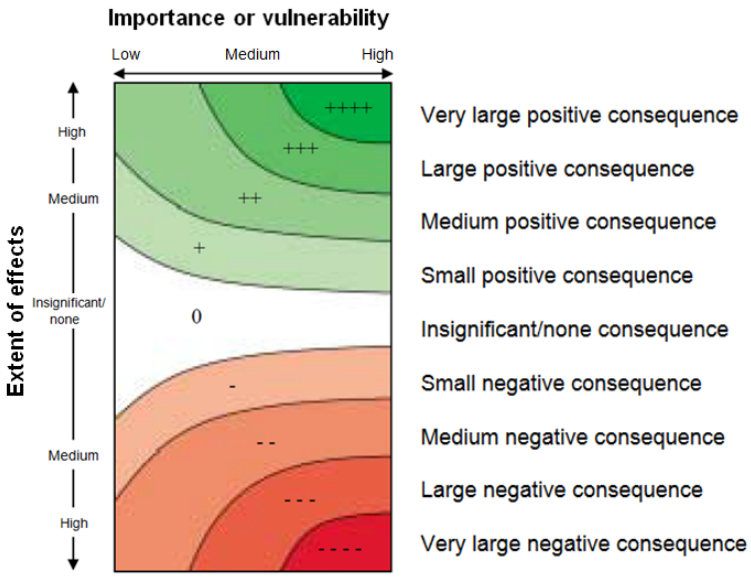


Figure 12. Method for assessing non-quantifiable impacts /22/

The criteria presented in Table 9 have been used to classify the importance and/or vulnerability of resources/recipients associated with the shut-down activities planned for the Rev field.

Table 9. Criteria used to assess the importance/vulnerability of resources/recipients

Importance/vulnerability	
Low	A resource/recipient which is not important to functions in the ecosystem, or one which is important but resilient to changes (in connection with project activities), and which will naturally revert to its pre-impact status when the activities stop.
Medium	A resource/recipient which is important to functions in the ecosystem. It is assumed not to be resilient to changes, but can be actively restored to its pre-impact status or will naturally revert within a reasonable time.
High	A resource/recipient which is critical to functions in the ecosystem. It is not resilient to changes and will not revert to its pre-impact status for a long time.

As mentioned in Figure 12 the assessed importance or vulnerability will influence the scale of the impact on a given aspect in many ways. To produce a "very large impact", the importance or vulnerability must be rated as high. In cases of lesser importance, "medium" is the highest possible impact.

4.2.2 Assessment of the extent of effects

The extent of the effects of a given impact will also vary substantially depending on the type of impact and what is affected. When assessing the extent of effects, we focus among other things on:

- Type and extent of impact (incl. geographical)
- Location (recipient)
- Time and duration
- Presence of natural resources or other parameters that could be affected
- Vulnerability of natural resources to the relevant impact
- Effects on individuals or populations

This, and the classification of impacts presented in Table 10 and Table 11, form the basis for the actual assessment of the extent of effects associated with shut-down activities planned for the Rev field.

Table 10. Classification of impacts in terms of nature, type and degree of reversibility

Nature of the impact	
Negative	An impact which is considered to represent a negative change to the baseline (current situation) or which introduces a new and unwanted factor.
Positive	An impact which is considered to represent a positive improvement to the baseline or which introduces a new and desirable factor.
Type of impact	
Direct	Impacts which are a result of direct interaction between planned project activity and the receiving environment.
Indirect	Impacts which are the result of other activities considered to occur as a consequence of the project.
Secondary	Impacts which occur after direct or indirect impacts as a result of subsequent interactions within the surroundings.
Cumulative	Combined impacts of other field activities and other human activities in the area (e.g. fishing).
Degree of reversibility	
Reversible	Impacts on resources/recipients that clearly cease either immediately a project activity ends or after an acceptable time.
Irreversible	Impacts on resources/recipients that persist after the end of a project activity which extends over a prolonged period. These are impacts that cannot be reversed by taking preventive measures.

The assumed impacts are further defined and assessed in relation to a number of variables, including intensity, scale and duration. The attribution of a value to the variables will generally be objective. In some cases, however, it will be subjective as the extent and direction of the change may often be hard to define. An explanation of the classification and the values used in the IA is given in Table 11.

Table 11. Classification of impacts in terms of intensity, geographical extent and duration

Intensity of impact	
Insignificant/none	Insignificant/no impact on the structure/function of resources/recipients within the affected area.
Small	Minor impact on the structure/function of resources/recipients within the affected area, but the underlying structure/function is unaffected.
Medium	Partial impact on the structure/function of resources/recipients within the affected area. Partial loss of structure/function of resources/recipients.
Large	Structure and function of resources/recipients completely changed. Loss of structure and function significant within the affected area.
Geographical extent of impact	
Local	Impacts limited to the area of the field (up to 1 km* from the centre and 1 km from the pipelines)
Regional	There will be effects beyond the immediate vicinity of the field (local impacts), and up to 3.5 km outside the area of the field.
National	Impacts limited to Norway.
International	Impacts will extend beyond Norway**.
Duration of impact	
Immediate	Impacts during and immediately after the project. Impacts cease when the activity stops.
Short-term	Impacts throughout the activity and for up to a year after the activity.
Medium	Impacts that continue over a prolonged period, between one and ten years after operations cease.
Long-term	Impacts that continue over a prolonged period, more than ten years after operations cease.

* the distance is based in the measuring stations included for Rev in the latest regional environmental analysis /30/
** based on the method used, there will be a serious impact if the effects of a measure have a cross-border impact, i.e. extend beyond Norway. For this study, there will be such cross-border effects in the sense that pipes run from Rev to Armada on the UK side. The geographical extent will nevertheless be local, so the impact will not be defined as serious in terms of geography.

4.2.3 Production of impact results

The terms and associated colours used in the Norwegian Oil and Gas Association's matrix (see Figure 12) have been used as the basis for the actual impact analysis in the IA. For each topic/problem discussed in the IA, the different criteria have been discussed and evaluated as described in the preceding sections. The outcome of the evaluation is then illustrated using a tabular matrix showing the final impact of the different topics/problems. This makes it clear which assessments form the basis for the final conclusion for each individual topic/problem.

4.2.4 Definition of topics for environmental impact

The impact assessment addresses topics/problems which cover the key environmental impacts of decommissioning the Rev installations. Table 12 briefly describes the different topics for environmental impacts.

Table 12. Explanation of topics for environmental impact

Environmental impact	Description of topics
Discharges to the sea	This topic deals with the effects of the measure in terms of discharges of environmentally harmful substances into the water. Such environmentally harmful substances may be direct discharges of chemicals or oil, or stirring up of sediments containing environmental toxins. This also covers gradual leakage of substances from pipes left *in situ*, for example.
Impact on the seabed	This deals with the direct physical impact on and in the seabed, and effects on the habitat for organisms. This includes physical damage to the sediments from digging, removal of pipes, rock-dumping etc.
Spread of contaminants	This is concerned with the spread of contaminants in the water, and polluted sediments being stirred up and resettling in areas away from the area of impact.
Impact on biota	This is concerned with direct or indirect effects on organisms which may be bottom-digging or bottom-living, in and on the sea.
Littering	This is about littering of the sea, both the seabed and the bodies of water. It includes objects left lying on the seabed, or covered on the seabed, such as pipelines. Also other objects left on the seabed. These do not necessarily affect the environment, but may be felt to have an aesthetic impact.
Aesthetic impact at the reception facility	This topic covers activities in or at the reception facility, and includes, noise, smell, dust, visual aspects or traffic. It also includes effects on recreational areas or tourism.
Waste management and resource utilisation	This is about the utilisation of resources, with re-use and recycling the best disposal solutions.

4.3 Topic-specific method of energy analysis and impact assessment of emissions into the air

The energy analyses are conducted in conformity with the recommendations given in the guidelines from the Institute of Petroleum (IOP) in London /39/ for offshore decommissioning activity. The analyses are based on estimates of the quantities of materials in the installation, the duration of marine operations and the type of vessels. The input data used to calculate energy (for melting down, fuel consumption etc.) is mainly taken from the IOP report. Aggregated knowledge of energy consumption from earlier decommissioning projects has also been used as a reference point.

The methodology used in the IOP report is based around a lifecycle approach, dominated by the following aspects:

1. Actual energy consumption associated with fuels/electricity for marine operations, and melting down of metals
2. Theoretical energy consumption from the production of new materials equivalent to the quantity disposed of (representing the potential energy savings from recycling).

Normally the calculations in an IA will be based on relevant technical studies which estimate the duration of the operations. Such estimates will not normally take account of factors in the surroundings that could potentially affect the duration of the operations. It is also possible for the duration to be affected by the contract strategy and removal method ultimately chosen. For this reason, it is recognised that there will be a degree of uncertainty in the estimates in the IA, estimated at 30-40% in the Norwegian Oil and Gas Association handbook /22/.

When it comes to emissions into the air, however, the focus is on the actual emissions. This is because many of the components are considered to have local or regional effects, so their geographical location is seen as an important parameter. This means that operations related to activities directly linked to the disposal solution form the basis for the assessments. Most of the emissions are associated with marine operations, but emissions from melting down are also included. The actual assessment of emissions into the air includes the parameters CO_2, NO_x and SO_2, with key indicators from the IOP database used in the calculations /39/.

5 Status report

5.1 Natural resources and environmental conditions

Several impact assessments have been carried out in the area; both regional impact assessments and local assessments and monitoring programmes. Natural resources and environmental conditions in the area where Rev is located are therefore well documented and described. The regional impact assessment for the North Sea /23/ provides a general description of relevant natural resources.

The report on “Overall management of the North Sea and the Skagerrak (management plan)” /25/ brings together existing knowledge of the environment and resources, commercial activity and environmental and social impact in the area where Rev is located. Available up-to-date knowledge is also used. This includes references /28/, /29/ and /40/, from the Norwegian Coastal Administration, the Norwegian Environment Agency and the Norwegian Institute of Marine Research. Data and annual reports from the Norwegian Directorate of Fisheries on fishing /26/, and monitoring results from the environmental studies on Rev (Region II) /30/ have also been used as part of this impact assessment. Environmental conditions around the Armada installation in the UK sector have been assessed using information gathered in various phases of development of the Armada project, from the initial seismic studies to the expansion of the field /31/, /32/ and /33/, and available databases such as the “Marine Environment Monitoring and Assessment National Database” (MERMAN) /34/. References /35/, /36/ and /37/ have also been used.

For the sake of simplicity, where the document talks about both the Rev field and the pipelines that go to the Armada field, this is referred to as the “project area”.

5.1.1 Description of the area

In the central area of the North Sea where Rev is located, there are relatively shallow sea areas with depths of less than 100 m. The waters also have lower salinity than the Atlantic Ocean – generally under 35. In the winter season the bodies of water are mixed, but in summer time there is a distinctly layered water column, with an upper layer of 10-20 m of warmer water. In this area, the water circulates along the coast and mainly anti-clockwise. There is a general easterly drift in this area towards Norway, modified by tides and wind. The principal currents in the North Sea and the Skagerrak are shown in Figure 13. The red arrows indicate inflows of Atlantic water, while the green arrows show the main directions of circulation of coastal water (coastal current).

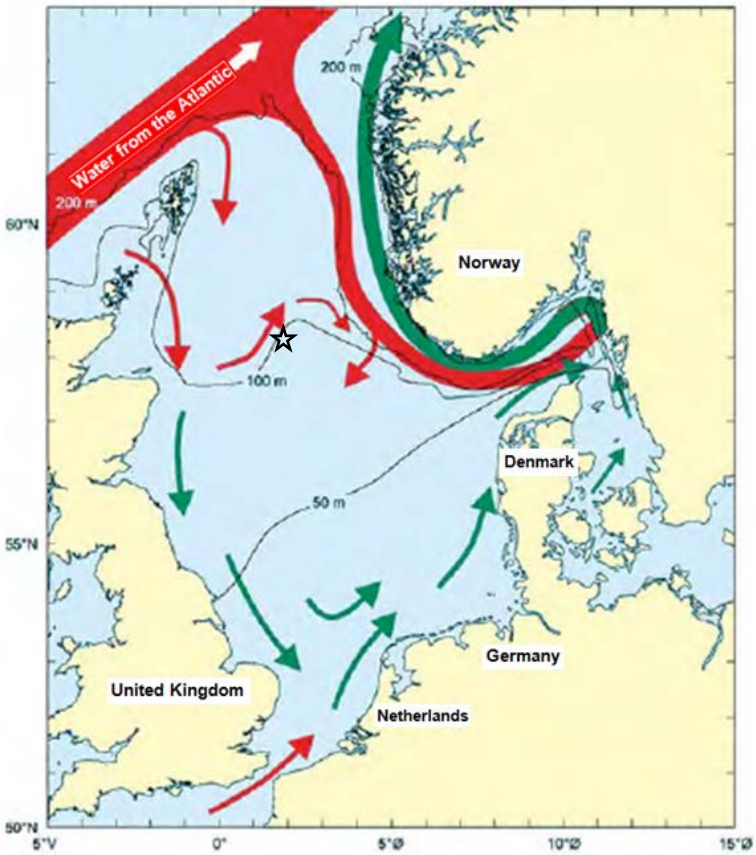


Figure 13. Schematic map of the general circulation and depths in the North Sea and the Skagerrak /25/. The position of Rev is marked with a star.

In shallow areas of the North Sea such as the project area, the pelagic and benthic processes in the bodies of water are often closely linked, contributing to high productivity. Different seasonal conditions will then cause phytoplankton production to vary. In winter, production is limited by a lack of light and low temperatures. Then the nutrient content of the other layers of water rises because the wind mixes the water vertically and input from the land increases. In the spring, on the other hand, conditions are more conducive to an inflorescence of phytoplankton. In this period, the light conditions will be better and vertical mixing will decrease. The inflorescence of phytoplankton itself provides the basis for the whole subsequent food chain, via zooplankton and fish to top predators such as birds, seals and whales.

Figure 14 shows the sediment conditions in the North Sea. In the project area, the sediments are made up of dense, fine sand with low levels of pelite and total organic material (TOM). Such sediments are normally exposed to little or no erosion.

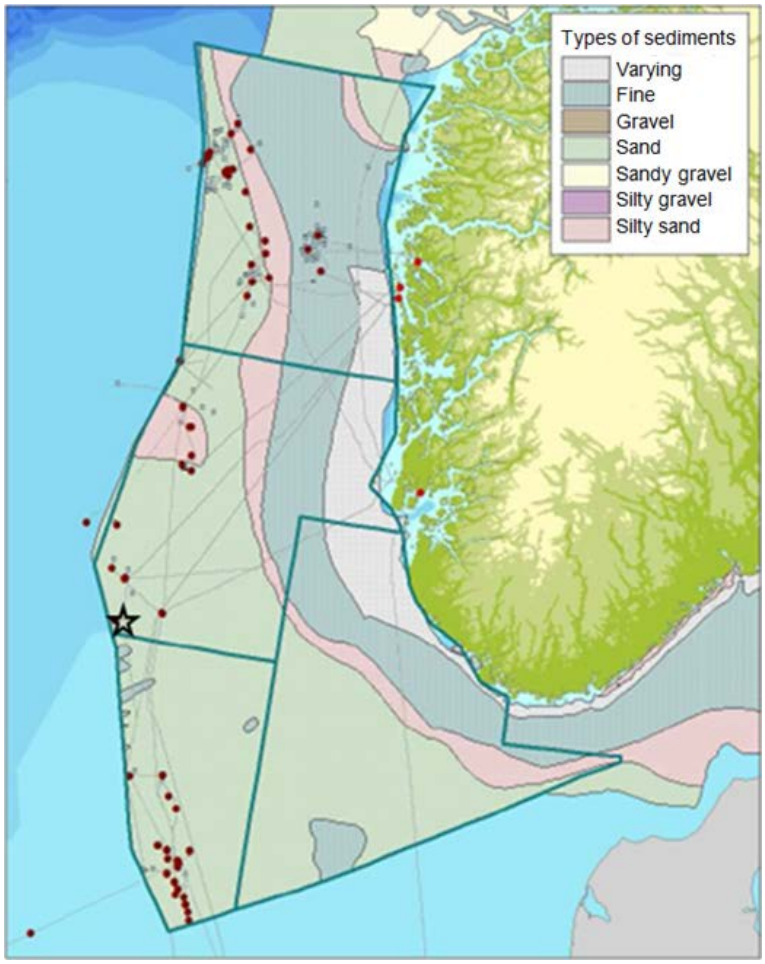


Figure 14. Sediment conditions in the North Sea /23/. The position of Rev is marked with a star.

5.1.2 Status of Rev (sediment and contaminants)

During the drilling processes, both water-based and oil-based drilling fluid was used. Something under 600 tonnes of drill cuttings were generated by the use of oil-based mud (OBM). The wells on Rev were all drilled after the ban on discharges of oily cuttings (> 1% oil, 10 g/kg) entered into force in 1993. All oil-based cuttings generated from drilling operations on the Rev field have therefore been taken ashore for further processing. Any cuttings discharged from the Rev field therefore originate only from drilling with water-based fluid.

Rev is located in Region II on the Norwegian continental shelf and forms part of the regional environmental inspection of the region carried out every three years. The first regional environmental inspection in Region II on the Norwegian continental shelf was carried out in 1997. The latest environmental inspection carried out in 2012 forms the basis for the description of the field in this section/30/.

Region II is usually divided into three sub-regions, and Rev is considered to fall into the southern sub-region (77-96 m) (as the Rev field has not been assigned its own regional sub-region). This sub-region is generally characterised by a smaller depth of water, more fine sand, smaller quantities of THC (total hydrocarbon), TOM (total organic material) and pelite, and less of the metals mercury, barium, copper and cadmium than the central sub-region (107-130m). Studies in the area close to the Armada installation (2009) showed a seabed consisting mainly of muddy sand with isolated areas of clay and rocks /38/.

The environmental inspection in 2006 found barium contamination to the north, west and south, as well as copper contamination to the south. The previous environmental inspection in 2009 showed THC values above the limit for significant contamination (LSC) at distances of 1000 metres to the north and 500 metres to the south. The analysis also showed that the barium content was over the limit for significant contamination (LSC) 1000 metres to the north, west and south.

Sampling was carried out in 2012 at six stations positioned in a sample grid around the field, as shown in Figure 15. As indicated in the figure, chemical samples were taken from all stations, while the biological samples were only taken at four of the stations. However, stations Varg S-19 and Varg S-14 were moved in 2009, the first because of the seabed installation and the other because there were a lot of rocks in the sediment. Only Varg S-19 was included in 2012.

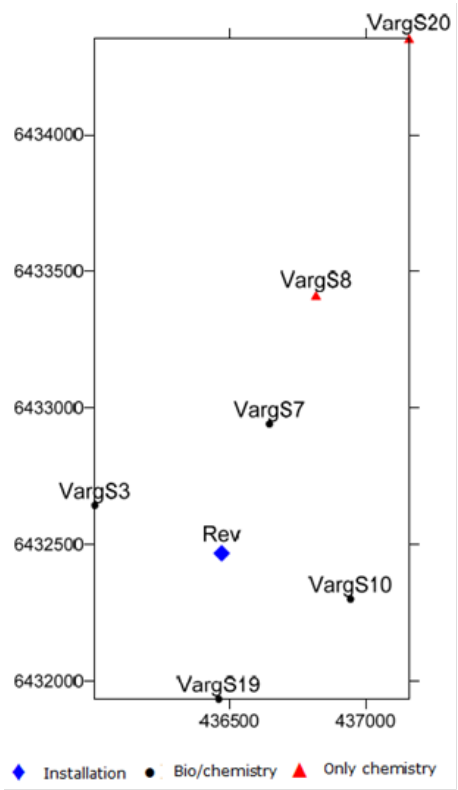


Figure 15. Location of the sampling stations in relation to the centre of the Rev field

The sampling included measurements of petroleum hydrocarbons (THC, PAH and NPD) and metals at the various stations on the Rev field. Sediment descriptions were also provided (physical properties such as particle distribution, organic content etc.), along with a description of bottom fauna (with details of specific species and individuals). The samples used for chemical analyses were taken from the top (0-1 cm) of the bottom sample (the Van Veen grab method). Selected chemical parameters are presented in Table 13.

Table 13. Mean concentrations of hydrocarbons and metals measured in 2012. Values over the LSC are highlighted.

Station	Direction/distance (°/m)*	Selected measured parameters (mg/kg TS)										
		THC	PAH	NPD	Ba	Pb	Cd	Cu	Cr	Hg	Zn	Ti
VARG S3	20/500	2	0.018	0.01	**103**	6.0	<0.01	0.8	8.6	0.01	7.9	92
VARG S7	20/500	2	0.029	0.01	**62**	5.9	<0.01	0.8	8.4	0.01	8	92
VARG S8	20/1000	1	0.012	<0.01	**35**	5.7	<0.01	0.7	8.1	0.01	7	90
VARG S10	110/500	3	**0.048**	0.01	27	5.6	<0.01	0.7	8.5	0.01	9	88
VARG S19	180/532	2	0.016	<0.01	**160**	6.7	<0.01	0.8	8.7	0.01	9	95
VARG S20	20/2000	2	0.012	<0.01	**-**	-	-	-	-	-	-	-
R2-15		2	0.011	<0.01	25	5.7	<0.01	**0.9**	8.6	0.01	9	80
Min. **		1	0.012	0.01	27	5.6	<0.1	0.7	8.1	0.01	7	88
Max. **		3	0.048	0.01	160	6.7	<0.1	0.8	8.7	0.01	9	95
$LSC_{regIIgrunn1997-2012}$		**6**	**0.033**	**0.02**	**31**	**6.7**	**0.1**	**0.8**	**10.6**	**0.01**	**10**	**173**

* Distance from centre of field

** Region not included

THCs were found in concentrations of 1-3 mg/kg, below the LSC for Region II ($LSC_{regIIgrunn1997-2012}$ 5.9 mg/kg THC). This is a reduction from the measured figures for 2009 and 2006. Measured PAH and NPD concentrations are below $LSC_{regIIgrunn1997-2012}$ (0.033 mg/kg PAH and 0.01 mg/kg NPD), except for Varg S-10 (500 m to the east) which had a PAH concentration of 0.048 mg/kg.

Among the metals, it is barium that stands out, with the highest mean concentrations at Varg S-19 (500 m south) and Varg S-3 (500 m west), at 160 mg/kg and 103 mg/kg respectively. Even when Varg S-19 and Varg S-3 were shown with a high standard deviation, re-analysis of the samples gave the same result. For these two stations, there is one parallel with high values, while the other two parallels fall into the same order of magnitude as the remaining field stations. The barium results are generally higher than the regional station R2-15 (25 mg/kg Ba). The other metals are at the same level as R2-15.

By comparison with $LSC_{regIIgrunn1997-2012}$ (30.8 mg/kg Ba), the analysis in 2012 showed increased barium values at four of the stations, as highlighted in Table 13 R2-15 shows a slightly increased concentration of copper compared to $LSC_{regIIgrunn1997-2012}$ (0.8 mg/kg Cu). The remaining metals, on the other hand, show no increased values compared to the LSC. Compared to earlier environmental analysis results, the barium values are slightly increased for all stations. Other than this, the results are at roughly the same level as in 2009 and 2006. Figure 16 shows the relative THC and barium concentrations between the stations in the Rev field in 2012.

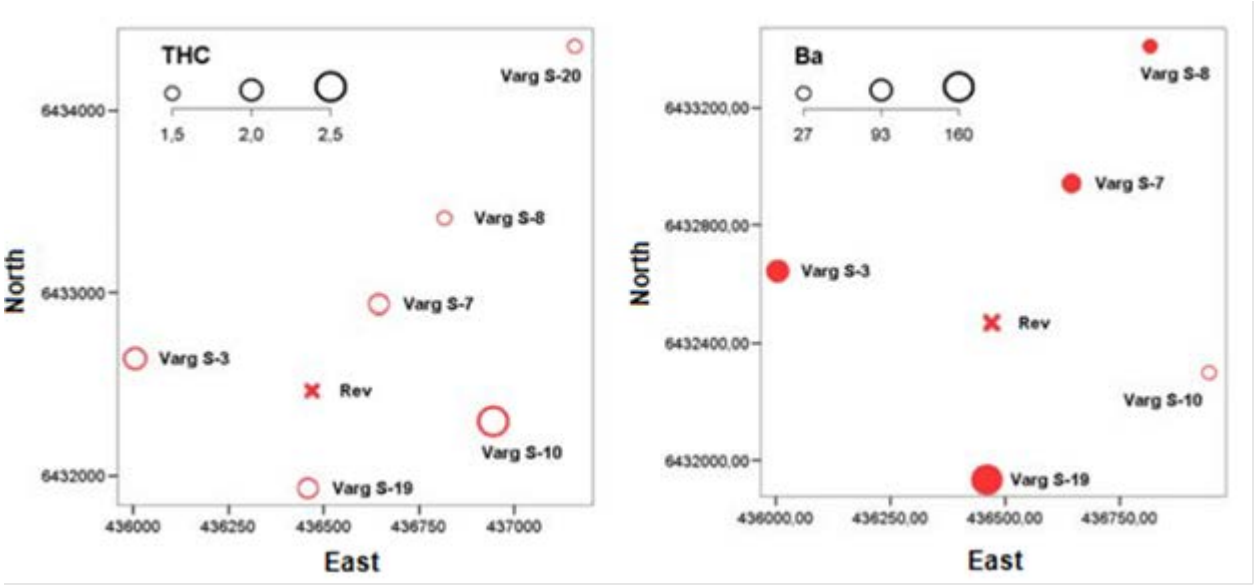


Figure 16. Relative concentrations of THC and barium in the sediment surface (0-1 cm) on the Rev field (X)

The environmental analysis carried out in 2007 along the pipeline from the Rev facility to the Armada platform showed that petroleum hydrocarbons (THC, PAH, NPD) and metals (As, Ba, Cr, Cd, Cu, Hg, Li, Ni, Pb, Sn, V, Zn, Li) were at a level similar to the background concentrations in the central North Sea /33/.

5.1.3 Plankton

The plankton system in the project area is assumed to be part of the typical pelagic system described for central parts of the North Sea. This produces a powerful spring inflorescence of phytoplankton (a number of groups and species) based on good access to nutrient salts, with the sunlight providing sufficient energy to start the spring inflorescence. The inflorescence culminates in late spring, and provides nutrients to the entire plankton system, as well as releasing microalgae to the benthic zone. The zooplankton in the North Sea is varied, with a number of species that live as plankton throughout their lifecycle (copepods, krill, arrow worms etc.), and larvae of countless species that live their adult lives in the water, on the seabed or in the beach zone (fish, echinoderms, coelenterates, barnacles, molluscs etc.).

5.1.4 Bottom fauna

The bottom fauna varies geographically according to the composition of the sediments. Depth, temperature and current conditions will also influence the breakdown of species, partly because most bottom-living species have larvae that are transported with the bodies of water. The bottom fauna is important as food for fish such as cod, haddock and flounders, as well as metabolising sedimentary organic material. The composition of invertebrates living on and in the bottom of the North Sea shows a difference between a southerly collection of species dominated by free-living organisms and a northern component more dominated by stationary bottom-living organisms. The

Rev field is located on the boundary between the northern and southern zones when it comes to bottom-living organisms.

The benthic community in the project area is very well described in the environmental analysis carried out in Region II /30/, and in the environmental analyses carried out in connection with the development of Armada and the nearly NW Seymour /31/. An environmental analysis was also carried out in 2009 in the area around Armada, which describes the bottom fauna /38/. Most of the biota comprises polychaetes, both in numbers of individuals and groups. There is also a high proportion of echinoderms, crustaceans and molluscs in the bottom fauna. The environmental analyses gave no indication of disturbances to the bottom fauna in the project area /30/, /31/. The results of the biological analysis of the Rev field showed no effect on bottom fauna. On the other hand, the diversity indices had decreased slightly since 2009, but they are higher than the values measured in 2006 /30/.

5.1.5 Fish

The predominant fish species in the free bodies of water in the North Sea are herring and sprat, which are present in the area all year round. Mackerel and scad are mainly present in the summer when they enter the North Sea from the south and the north-west. The dominant gadoid species are cod, haddock, whiting and coley, while the most important flatfish are the common plaice, American plaice, dab, common (Dover) sole and lemon sole. Sand eels, pout and herring are the major plankton-eating fish populations in the North Sea.

In the central parts of the North Sea, the adult herring are replaced by brit. Sprat are present, and gadoid species are dominated by whiting and haddock. Large parts of this area are generally less rich in fish than further north, and it is marked by lower primary production. In the eastern part of the North Sea, at depths of 50–100 m, there are growing areas for herring and cod. Here there are also important areas for sand eels, and it is the main habitat for flounders. Table 14shows the major fish species in the North Sea.

Table 14. Major fish species in the North Sea; what they eat, spawning season and habitat

Species	Food	Spawning season	Habitat
Cod	Crustaceans, sand eels, herring and pout	January and April	Bottom-living, but prey in higher layers
Coley	Copepods, krill, larvae and spawn, pout and herring	January to March	Pelagic, but also prey on the bottom.
Mackerel	Plankton-eaters, fish larvae and small fish	May - July	Pelagic, shoals
North Sea herring (key species in the area)	Plankton, including krill and copepods	Autumn	Pelagic, shoals
Pout	Crustaceans, including krill and copepods	March to April	On muddy bottom
Sand eels (key species in the ecosystem)	Plankton	November to February	Sandy bottom, dig themselves into the sand, hibernate in winter

5.1.6 Marine mammals

Apart from the Norwegian trench, the North Sea is a shallow sea area with depths from 50 to 200 metres in the northernmost parts. This makes it little-suited as a habitat for large cetaceans. Three smaller species of cetacean do however appear regularly in the North Sea: minke whales, porpoises and white-beaked dolphins (jumpers). They are found over large areas of the sea and prey on fish such as sand eels, herring and mackerel, and also on zooplankton. Porpoises and white-beaked dolphins are regional, while minke whales mainly pass through the area in search of food and are most numerous in the areas in the north and west of the North Sea.

Porpoises are by far the most numerous cetaceans in the North Sea and censuses taken in the period 1994-2005 indicate that the population in this period was relatively stable. There may however be great changes from year to year in the distribution of porpoises and minke whales in the North Sea, presumably reflecting changes in the prey situation.

“Jumpers” is a collective term for white-beaked dolphins and Atlantic white-sided dolphins. The white-beaked dolphin is by far the most common in the North Sea area. It is assumed to eat fish in the free bodies of water. Other cetaceans, both whales and dolphins, occur sporadically in the area.

There are two species of seal in the North Sea, common seals and grey seals. Both of these species are indigenous and live mainly near the coast.

5.1.7 Seabirds

Seabirds are an important component of the coastal and marine environment, not least as a very visible element at the top of long food chains. Population trends, survival and reproduction among seabirds are good indicators of the status of marine ecosystems. The North Sea (including the Skagerrak) is home to large populations of seabirds. However, there are few species of seabird that nest in the North Sea. This is mainly because there are no large nesting cliffs in the area. It also means that most large colonies of cliff-nesting species are north of the Arctic Circle. The North Sea and the Skagerrak are nevertheless an important area for many populations of seabirds. In the nesting season, the area is mainly important for populations living in southern Norway and north-eastern parts of Great Britain. Outside the nesting season, the area is important as it is used by seabirds from the nesting areas further north.

The populations of seabirds vary greatly with the seasons, and the birds often use quite different areas in the winter and summer. Most seabirds live on the coast or in waters relatively near the coast and close to the nesting area or colony in the nesting season. We may however find that some species, such as fulmars, travel much further between each visit to the nesting location. Auks, on the other hand, stay closer to the colony in the nesting season. Some species – such as gannets, fulmars, kittiwakes and auks – spend most of the winter out at sea. During the swimming migration in the first month after nesting, there may be a significant number of unfledged auks in the open North Sea and on the banks.

Birds on the open sea are hard to quantify, and there are great variations between years and between areas. There may be large gatherings, especially in areas with a high density of prey such as pelagic fish, and through flocking in some periods of the year. Based on the available

information, the Rev area is no different from other parts of the North Sea in terms of particularly high densities of seabirds.

5.1.7.1 Seabirds and environmental importance

The website of the Norwegian Environment Agency contains assessments of environmental importance in Norwegian sea areas /41/. The distribution of species, habitats and ecosystem functions determines the environmental importance of these areas of the sea. When seabirds nest, they seek out certain favourable places where they gather in large numbers. Such places are examples of areas of great environmental importance.

NINA and the Polar Institute are responsible for updating and quality-assurance of their respective seabird databases, and they cooperate on the presentation of the data through SEAPOP, with some support from the oil industry. The data for the open sea, which also covers the Rev area, is based on model data, where the incidence is modelled from shipboard data over almost 30 years and environmental parameters and geography through GAM models /42/. The data from the North Sea and the Skagerrak includes data from institutions in all the North Sea countries in the "Seabirds at Sea" database which was a precursor to today's SEAPOP.

A description of the importance of seabirds on the open sea is based on a number of parameters such as national status, status of the species on the red list, whether it is a species of national responsibility etc. A more detailed description of the criteria for determining environmental importance is given in /43/.

Figure 17 shows the environmental importance of seabirds in the central and southern parts of the North Sea /43/. This reveals that the Rev field is located within an area of medium environmental importance (6 to 7) for seabirds in the period from December to March, while it lies outside such areas for the rest of the year. In the period
December to March, this is seen as an important area because of the presence of guillemots - open sea, with criteria descriptions K2 Areas important to life (value 1), and K3 Threatened, vulnerable or declining species (value 3). This shows that the area has a relatively high environmental importance because of the presence of guillemots on the open sea in the winter period, as the species is threatened, vulnerable or declining.

In the spring, summer and autumn period (April – November), the areas near the coast have the highest environmental importance, and no special environmental value is recorded for the Rev area itself in this period. In adjacent areas around Rev there are areas of special environmental importance 6 to 7 in this period too /41/. Nevertheless, we may conclude that the project area is not a particularly important area for seabirds.

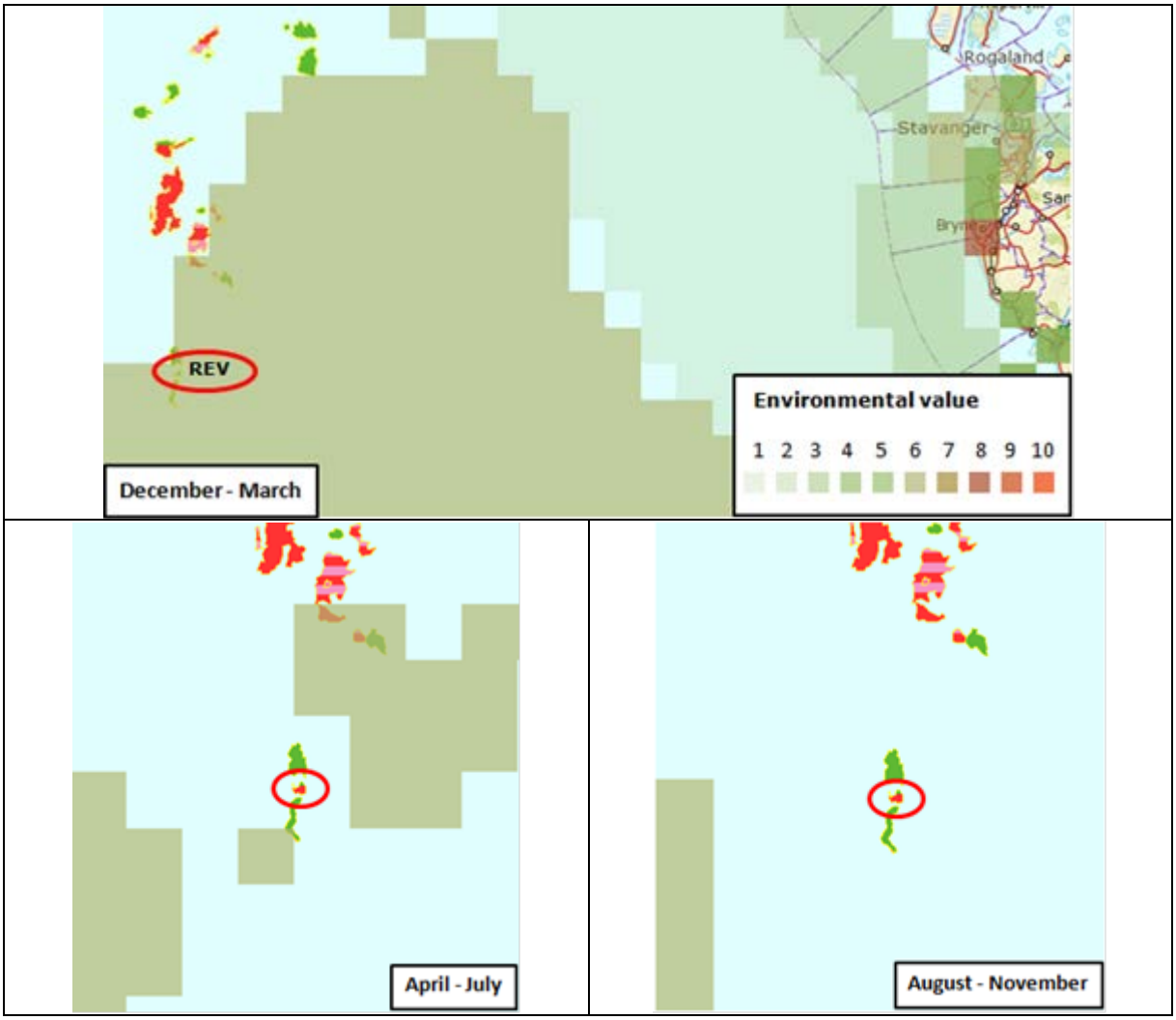


Figure 17. Overview of the areas of special environmental importance for seabirds close to the Rev field. The assessment is based on areas and periods important to life, percentages of the national population and red list status, taken mainly from the NINA and Polar Institute seabird databases./41/

5.1.8 Areas of special importance

The work on the "Overall management plan for the North Sea and the Skagerrak" analysed and described the technical basis through several specialised reports. The report on "Vulnerability of areas of special importance exposed to petroleum operations, shipping, fishing, land and coast-based activity and long-haul pollution" forms part of the technical basis for the management plan for the North Sea and the Skagerrak /25/. It defines several areas which are regarded as especially important based on resources (fauna), habitats, landscape, history and geology. Figure 18 shows an overview of the areas of special importance (ASI) in the North Sea and the Skagerrak. All of the identified areas are generally vulnerable, but the degree of vulnerability varies according to the factors they are exposed to and when this happens. The figure also shows that the Rev field is

outside any defined areas that are especially important and vulnerable, but to the east and south of Rev there is an ASI defined on the basis of spawning areas for mackerel. However, spawning areas for fish like mackerel are dynamic, and we may expect mackerel to spawn in the Rev area also. In the UK sector close to the Armada installation, spawning areas for mackerel, pout and sand eels have been identified /31/. No evidence of sensitive habitats has been found in the area around the Armada installations which are protected under the EU Habitats Directive, supplementary provision 1 /38/.

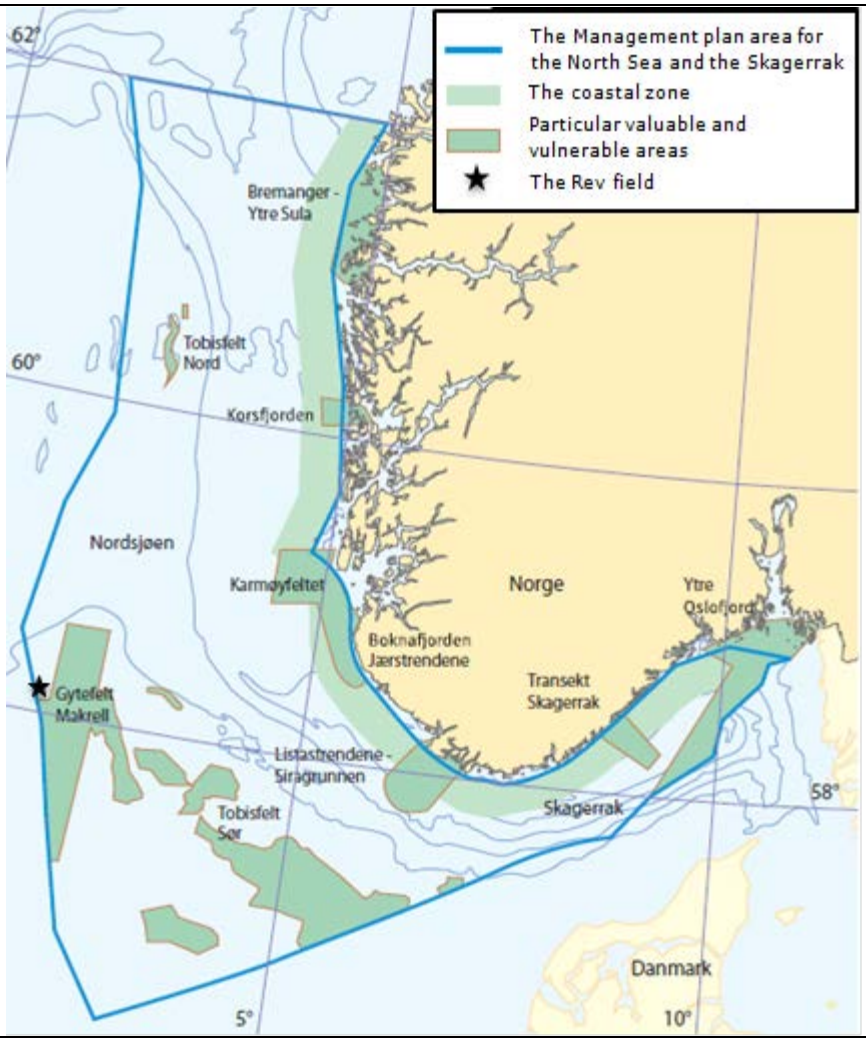


Figure 18. Particularly important and vulnerable areas of the North Sea and the Skagerrak /25/

5.2 Public interests and commercial activity in the area

5.2.1 Historic monuments

There is generally potential for finding historic monuments on the Norwegian continental shelf, in the form of Stone Age remains and of shipwrecks. Finds from the Stone Age on the Norwegian continental shelf will typically be in the top 50 cm of the bottom sediments. Typical objects are various types of stone tools, although finds of organic materials cannot be ruled out either.

The Norwegian Petroleum Museum has been tasked by the Petroleum and Energy Directorate, the Norwegian Petroleum Directorate and the Norwegian Oil and Gas Association with producing a cultural heritage plan for the petroleum sector. This includes a priority list of areas that the industry, the professional authorities and the Directorate for Cultural Heritage define as the most interesting historic monuments from the petroleum industry, with A as the highest priority and D as the lowest. The Rev installation has been assigned priority D, the lowest priority.

Figure 19 shows the distribution of known shipwrecks along and off the coast. The figure shows that the Rev installation is not in an area with a large number of recorded shipwrecks. Nor have any wrecks been recorded in the inspections carried out on the field. No shipwreck is recorded in the area around the Armada installation in the UK sector /32/.

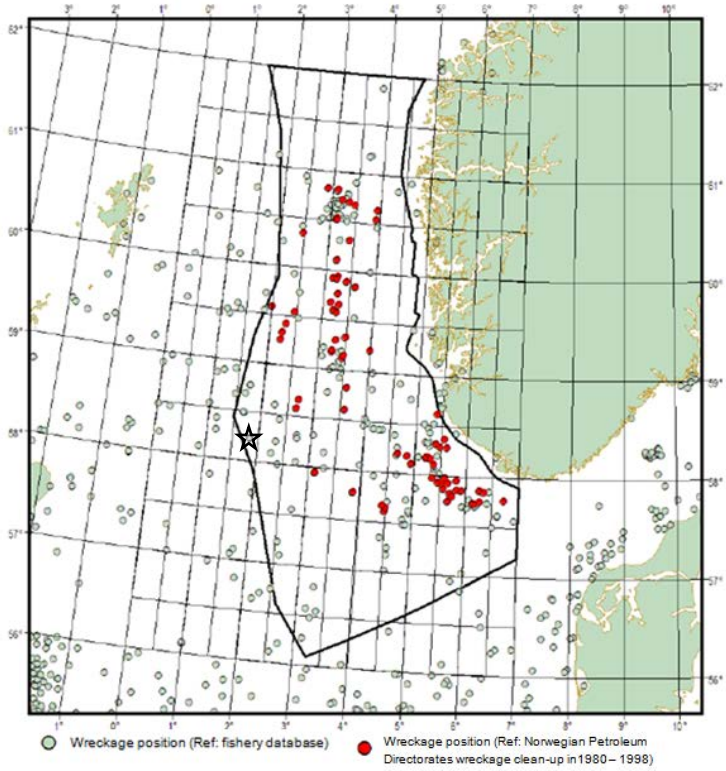


Figure 19. Overview of shipwrecks from the Fisheries Database and the Norwegian Petroleum Directorate /44/. The Rev field is marked with a star.

5.2.2 Fishing

Several commercially important species of fish have their spawning grounds and growing areas in the North Sea. Moreover, the North Sea is regarded as an important area for Norwegian fisheries interests. The total volume of fish in the North Sea has varied between 11 and 15 million tonnes over the last 20 years. The bulk of the fish are cod, coley, mackerel, herring, blue whiting, pout, sand eels and prawns. There was good recruitment to the age-group for pout in 2012. The spawn stocks for coley and autumn-spawning North Sea herring are in good shape. For cod there has been a gradual increase in the spawn stocks, but the population is still critically low. Sand eels, cod and herring still have low levels of recruitment /40/.

Many different types of fishing gear are used for specific species based on their special characteristics such as behaviour, migration and spawning routes. The types of fishing gear described in Table 15 are used by the Norwegian coastal fleet for the species that are present in the North Sea. Figure 20 also shows examples of two types of fishing gear used in the North Sea. In the Rev area, it is mainly bottom trawling that is used.

Table 15. Overview of fishing gear and associated fish species

Main group	Type	Fish species
Nets	Bottom, pelagic and drift nets	Cod and coley
Hooked gear	Line, hand and trolling line	Cod and mackerel
Trawl	Bottom, pelagic and semi-pelagic	Pout, sand eels, cod and coley, some herring, mackerel and smelt
Seine	Purse seine and beach seine	Herring, mackerel and smelt

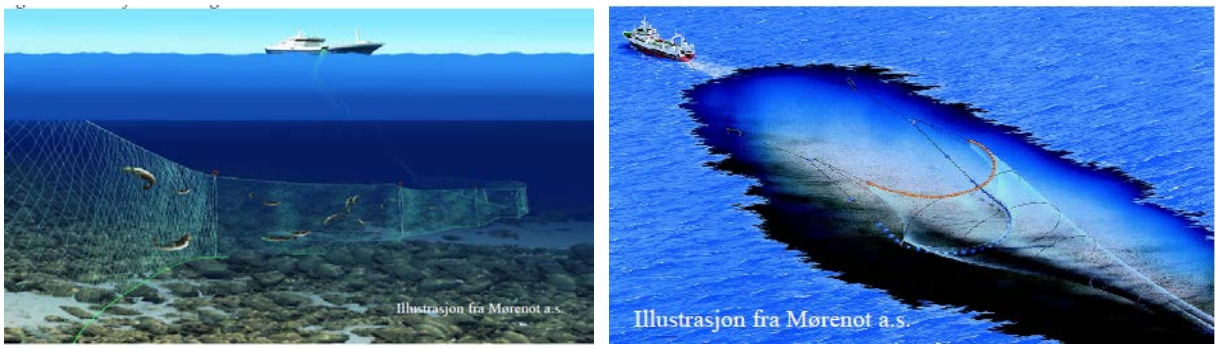


Figure 20. Examples of fishing gear (nets and trawls)

Satellite tracking using AIS gives a very good overview of where fishing activities (with vessels above the tracking limit) are taking place at any time. The tracking limit set for fishing vessels is 15 m for Norwegian and EU vessels, and 24 m for foreign vessels. The satellite tracking data for large fishing vessels in the Rev area is taken from the Norwegian Directorate of Fisheries. This has

been processed and presented in Figure 21 and Figure 22, which illustrate quarterly records of Norwegian and foreign fishing activity around the Rev installation for 2012 and 2013.

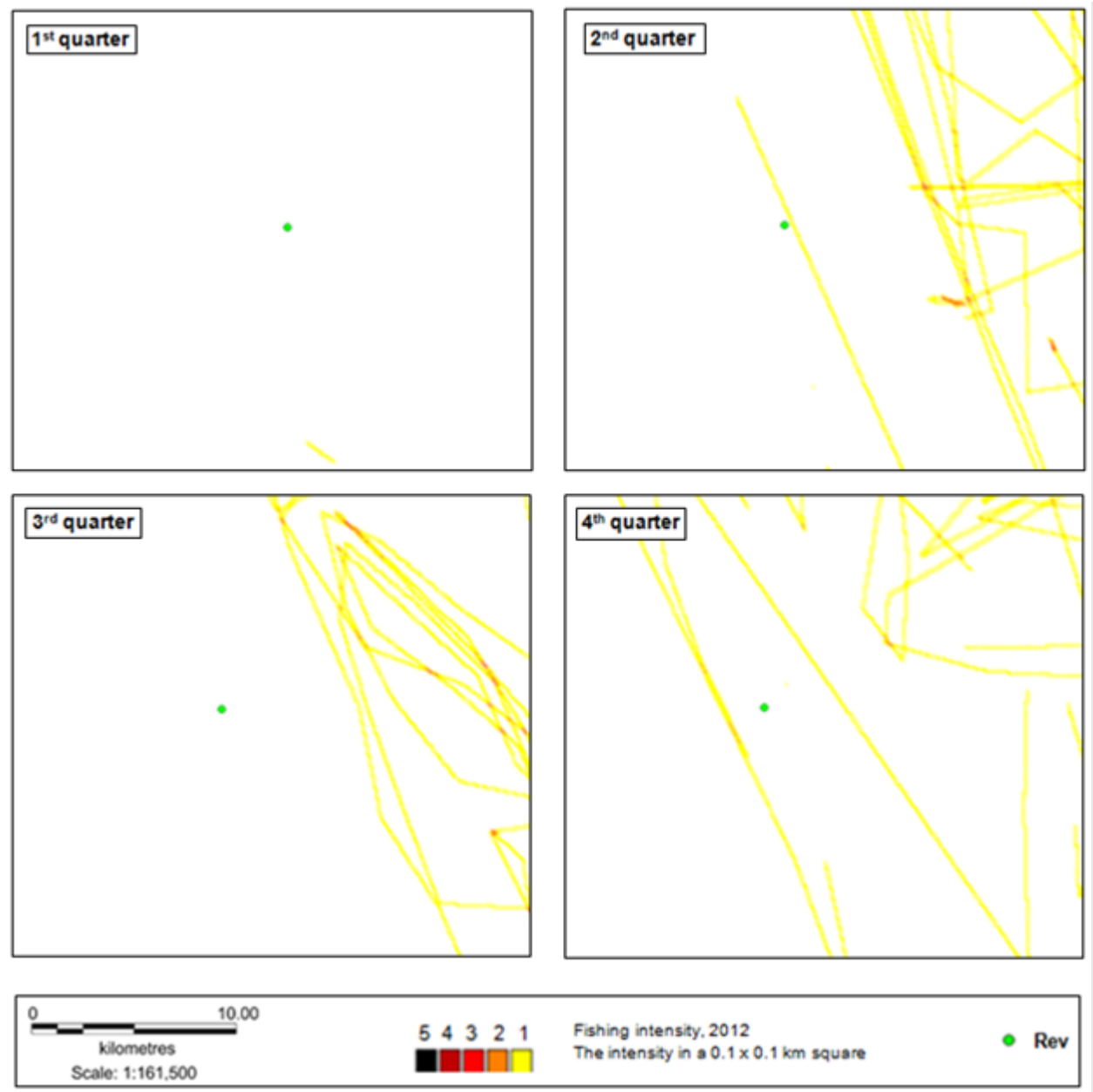


Figure 21. Recorded Norwegian and foreign fishing activity in the area around Rev in 2012. The figure is based on data from the Norwegian Directorate of Fisheries' satellite tracking of large fishing vessels (AIS).

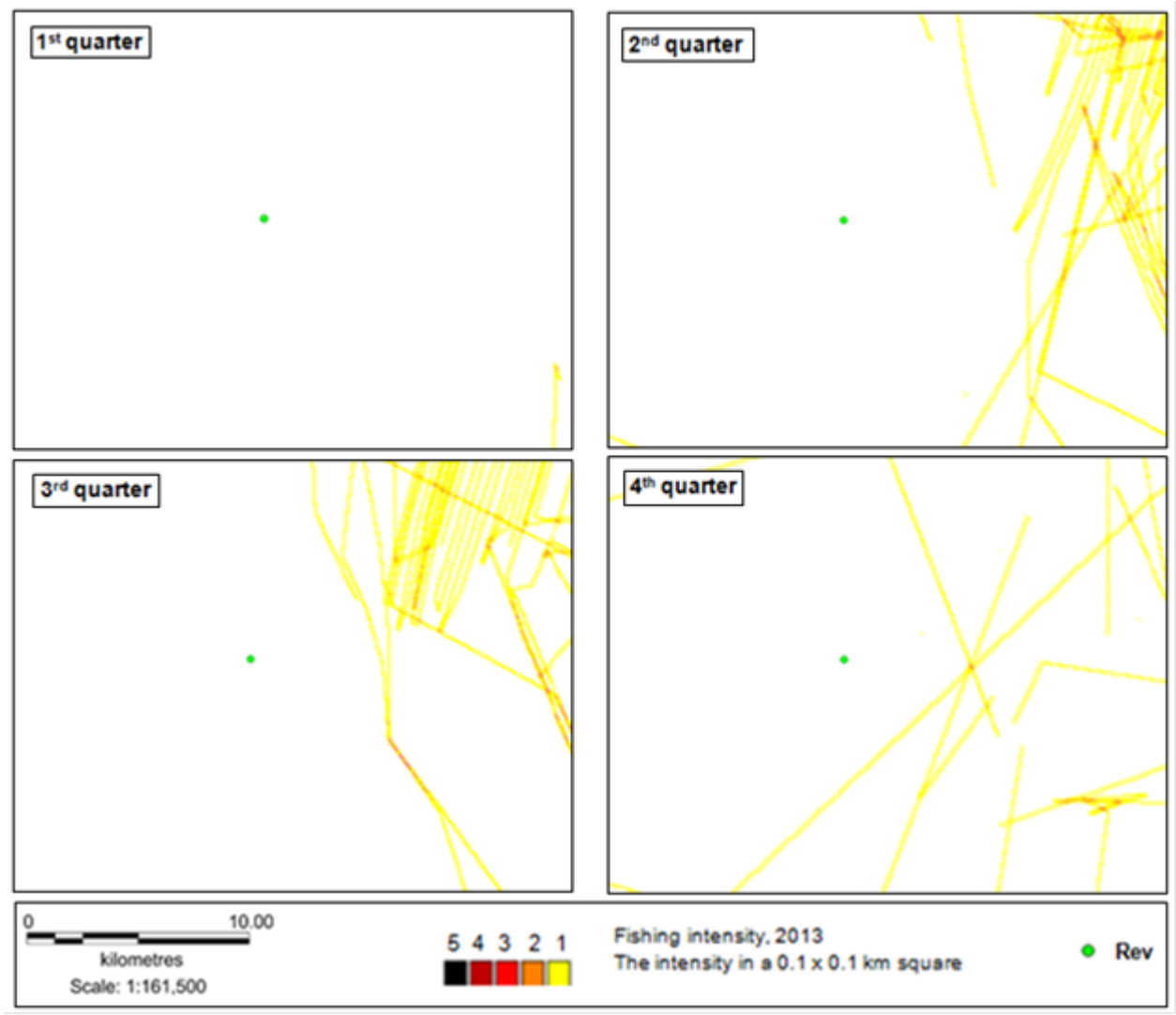


Figure 22. Recorded Norwegian and foreign fishing activity in the area around Rev in 2013. The figure is based on data from the Norwegian Directorate of Fisheries' satellite tracking of large fishing vessels (AIS).

The results from satellite tracking in 2012 and 2013 show that there is a significant amount of fishing in the area to the east of Rev in Q2 and Q3, while there is almost no fishing activity in the area in Q1. There is limited fishing in the vicinity of Rev in Q4. The fishing activity is slightly higher in 2012. Fishing activity around the Armada installation is at a relatively low level /31/, /32/.

5.2.3 Shipping

The North Sea is one of the world's busiest shipping areas, used by various types of ship. Many different transport routes pass through the area, including transit to the northern areas along the Norwegian coast, traffic to and from the Baltic and traffic between the major ports in Norway and

other North Sea countries. Compared to other Norwegian sea areas, shipping in the North Sea (and the Skagerrak) is more complex and more large-scale. The bulk (3/4) of the maritime traffic in the North Sea is outside the Norwegian economic zone, with the southern part seeing particularly dense traffic. Figure 23 shows the density of shipping within the North Sea and Skagerrak management area. It can be seen that the Rev field (including the project area) is outside the most heavily used shipping areas.

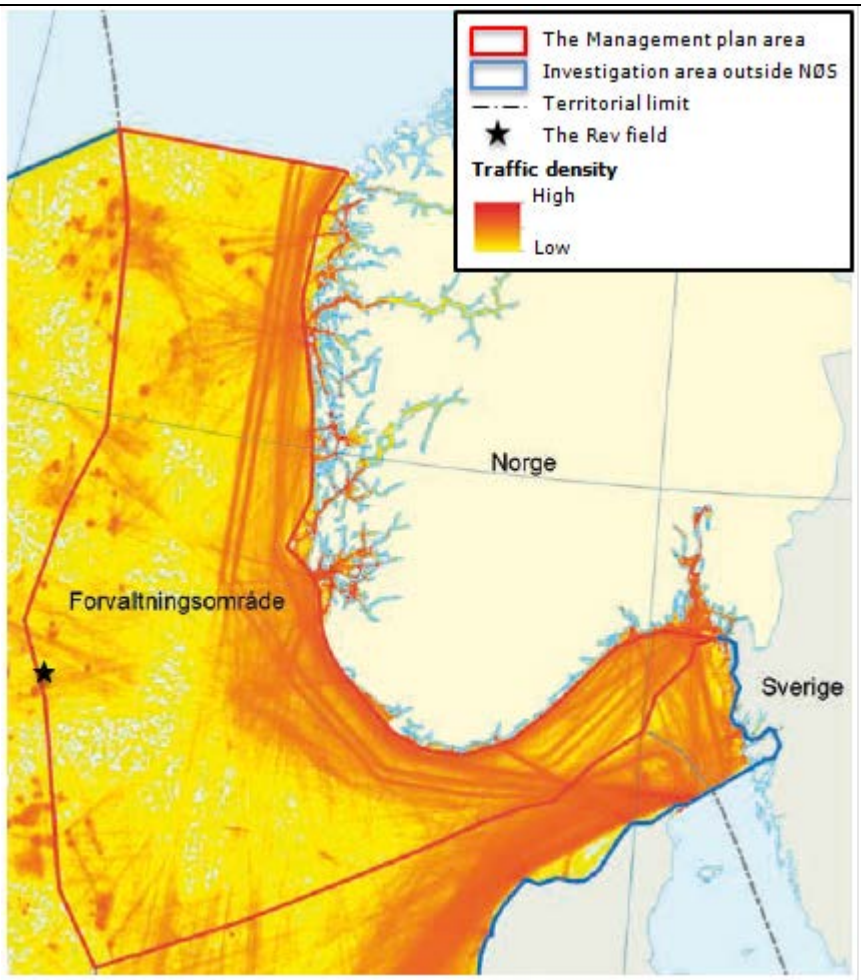


Figure 23. Density of shipping in the North Sea and the Skagerrak in June 2011, based on AIS data /25/

6 Environmental impact and preventive measures

As described earlier (see section 2.2), it is planned to completely remove the seabed installations and take them ashore to be dealt with further. For the pipelines connected to the Rev field, the following options are being evaluated:

1. Leaving the entire pipe system *in situ* (base case)
2. Removing the entire pipe system
3. Removing rockdumped pipes/control cables and leaving buried pipes/control cables *in situ*

Environmental and social assessments linked to these solutions are described in sections 6 and 7.

6.1 Energy assessments

The energy need for marine operations is estimated from the calculated volume of activities, including preparatory work offshore, type of vessels used, mobilisation and demobilisation of vessels, and duration of the operations. A waiting time of 15% for the various vessels has also been factored in. International standards /39/ for fuel consumption have also been used in the calculations. For options 1 and 3, the calculations assume a replacement value for the materials left *in situ*. This gives a theoretical energy consumption for the production of new materials (including steel) according to the amount left behind. It should be emphasised, however, that the energy calculations are only approximate, as it is still early in the planning phase and there are uncertainties with regard to the options being evaluated. For example, there will be uncertainties as to the duration of the marine operations, but this is true of all the options, so it will not have a major bearing on the results.

Based on information from earlier removal projects and associated energy calculations, it is clear that the marine operations are the most energy-demanding. In comparison, energy associated with dismantling / cutting operations and transport on shore makes up a modest proportion of the total. This is also reflected in the energy balance from decommissioning the Rev field, as shown in Figure 24. This shows that removal of seabed installations and all pipes (option 2) has the highest estimated energy need, just under 110,000 GJ. The marine operations account for 89% of this. For options 1 and 3, the estimated energy consumption is relatively similar, around 60,000 GJ. Most of the energy consumption comes from the marine operations, followed by replacement of the materials left *in situ*.

If we use the proposed impact scale from the Norwegian Oil and Gas Association for energy consumption for offshore decommissioning /22/ the energy consumption for option 2 is considered to fall within the impact category “slightly negative”, while options 1 and 3 fall into “insignificant/none”.

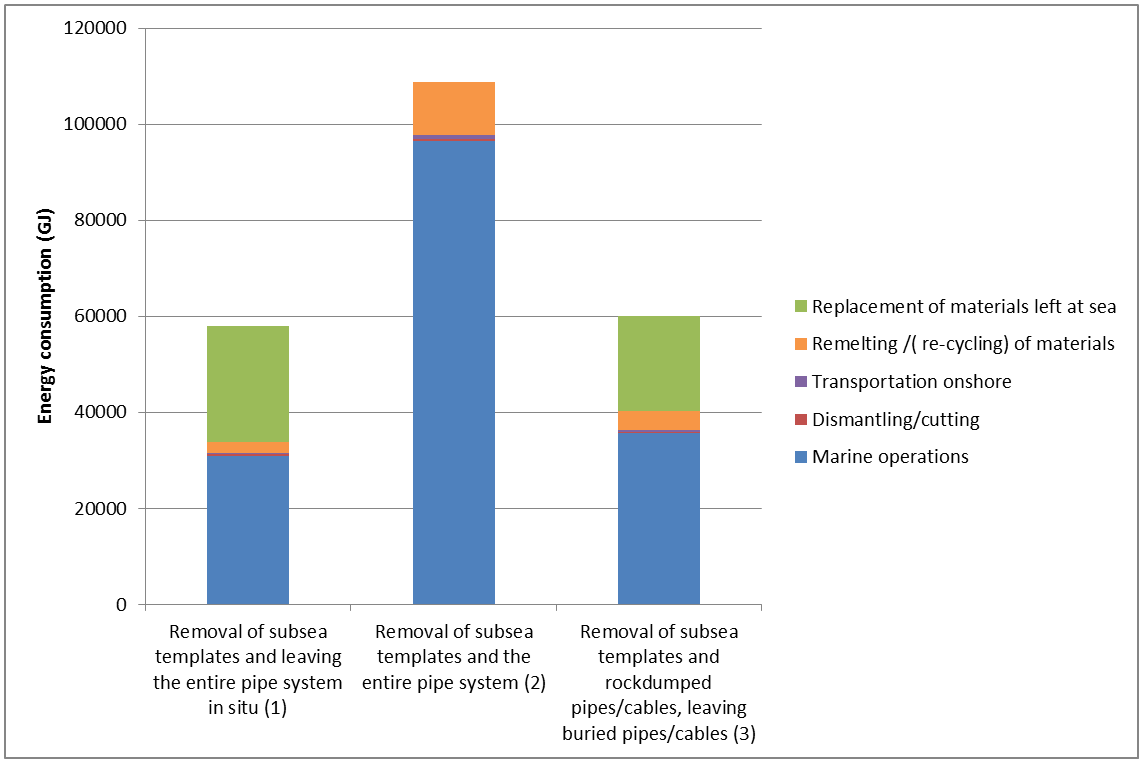


Figure 24. Energy balance for the different disposal options

6.2 Emissions into the air

Emissions into the air from removing and cutting up offshore installations mainly come from burning fossil fuels in the marine operations, and from recycling of materials. The removal options will involve the use of various types of vessel to prepare for removal and for the actual removal operations, and will contribute to emissions into the air. It should be emphasised, however, that the emission calculations are only approximate, as there are uncertainties with regard to both options being evaluated.

Emissions into the air from marine operations are estimated from the calculated volume of activities, including preparatory work offshore, type of vessels used, mobilisation and demobilisation of vessels, and duration of the operations. A waiting time of 15% for the various vessels has also been factored in. International standards /39/ for emission factors have also been used in the calculations. For options 1 and 3, the calculations assume a replacement value for the materials left *in situ*.

For emissions from operations on shore, estimates are based on the weight of material and international standards /39/. As the location for cutting up and melting down is not known at this time, there will be very great uncertainty and many unknown factors in terms of the means of transport to be used to take the material ashore and the distance the materials will have to be

transported for various processes. For this reason, the transport of materials on land has not been included in the calculations of emissions into the air.

Figures 25-27 show the estimated amount of emissions into the air (of CO_2, NO_x and SO_2) for the three disposal options for seabed installations and pipes from the Rev field. The figures show that the marine operations account for most of the total emissions. Overall, the option which includes removing the entire pipe system (2) comes out much higher than the two which involve leaving it *in situ* (1 and 3).

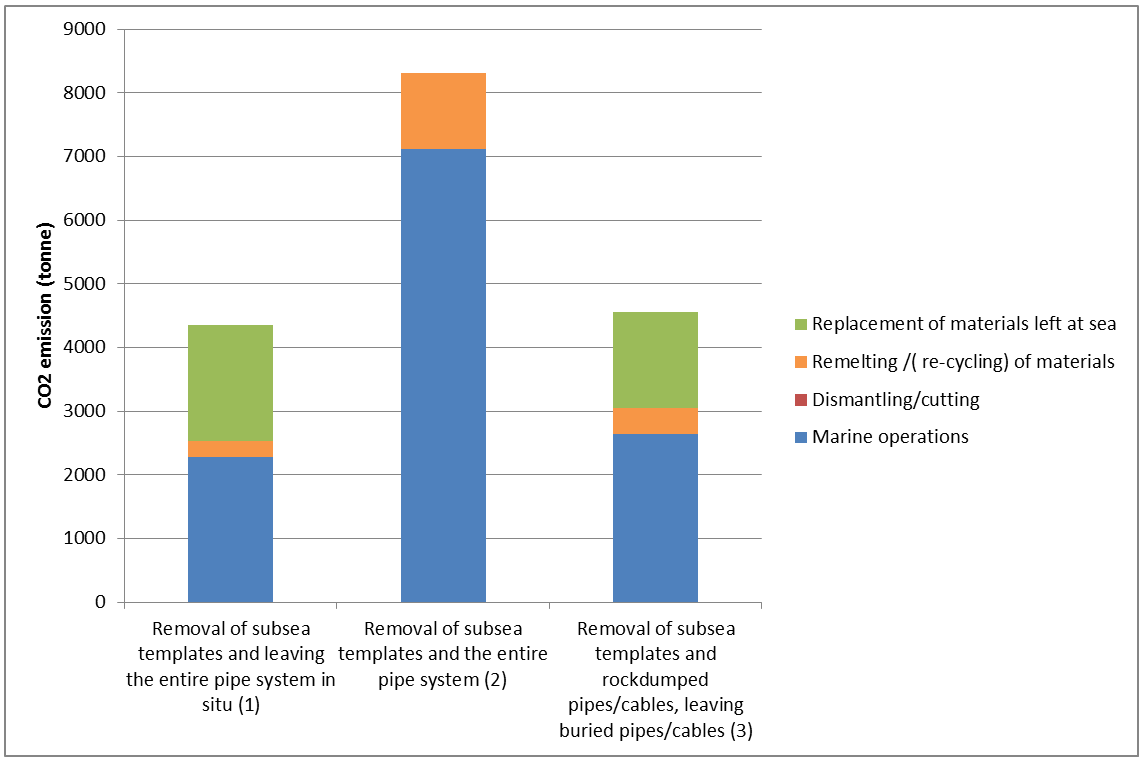


Figure 25. Estimated CO_2 emissions for the different disposal options

The total CO_2 emissions are around 8,300 tonnes for option 2, and approx. 4,400 tonnes and 4,600 tonnes for options 1 and 3 respectively. If we compare these with the total emissions from the petroleum industry on the Norwegian continental shelf in 2012, the total CO_2 emissions from decommissioning the Rev field come out at 0.08% (option 2) and 0.04% (options 1 and 3) /45/.

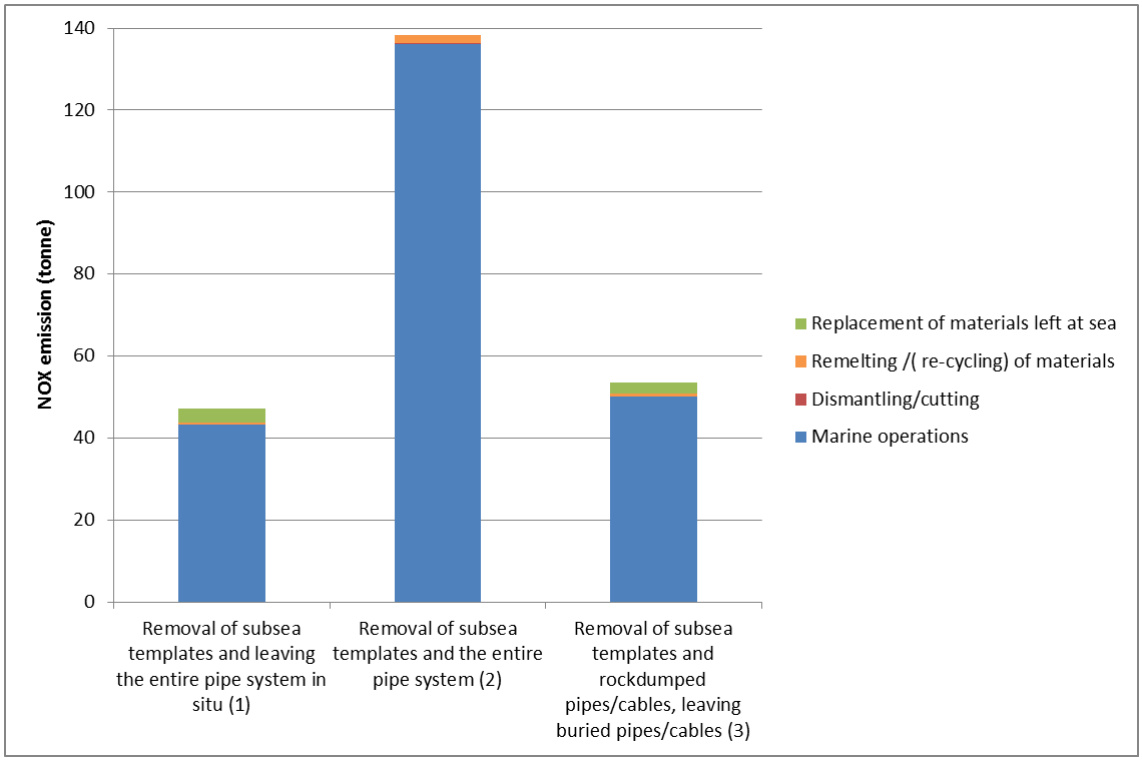


Figure 26. Estimated NO_x emissions for the different disposal options

As can be seen from Figure 26 the total estimated NO_x emissions come to approx. 50 tonnes (option 1), 140 tonnes (option 2) and 54 tonnes (option 3), with the marine operations accounting for 91%, 99% and 93% respectively. For comparison, the total NO_x emissions from the petroleum industry on the Norwegian continental shelf came to 44,504,670 tonnes in 2012 /46/.

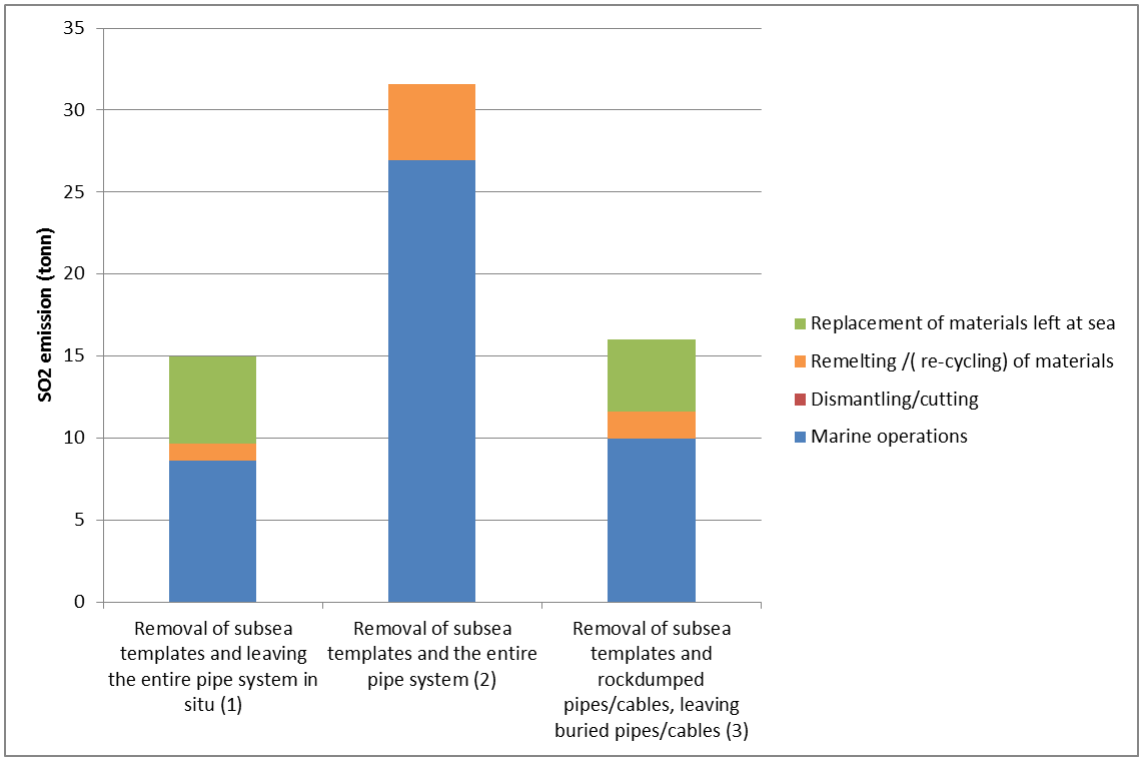


Figure 27. Estimated SO_2 emissions for the different disposal options

It can be seen from Figure 27 that the total SO_2 emissions from the different options are estimated at 15 (option 1), 32 (option 2) and 16 tonnes (option 3). It should also be stressed that the calculations are based on slightly outdated data (2000) /39/. For this reason, it is reasonable to assume that today's cleaning technology has improved and that the actual SO_2 emissions from melting down materials will be slightly lower than estimated for the decommissioning solution. If we compare these with the total emissions of sulphur oxides from the petroleum industry on the Norwegian continental shelf in 2012, the estimated SO_2 emissions come out at 0.002% (options 1 and 3) and 0.005% (option 2) /47/. The percentages will however be rather different when compared only with the total SO_2 emissions on the Norwegian continental shelf.

By way of comparison, option 1 (removal of seabed installations and leaving the entire pipe system *in situ*) has the lowest estimated emissions for all groups (CO_2, NO_x and SO_2). Again, there is no great difference between options 1 and 3. Option 2 is estimated to produce significantly more CO_2, NO_x and SO_2 emissions.

The Norwegian Oil and Gas Association handbook /22/ does not specify any quantitative categories for stating the impact of emissions into the air. The reason for this is that many of the components being assessed may have differing effects of a geographical nature. CO_2 emissions will contribute to global warming, which is a consequence of various inputs, making it hard to pinpoint the significance of each individual source. Emissions of NO_x and SO_2 may contribute to various types of environmental impact of a regional and local nature. The location of emissions (immediate

vicinity, region, previous levels and limits of toleration) will then be crucial to the extent of the impact, making any general quantification difficult.

As most of the marine operations will take place far out at sea, and the location for cutting up and melting down is not yet known, the impact of these emissions has not been assessed further. The scale of emissions from decommissioning the Rev installation and associated infrastructure is modest when taken in isolation but, together with other sources, could contribute to negative environmental consequences. The challenge will therefore be to carry out the various operations in the most energy-saving way possible, so as to minimise emissions into the air.

6.3 Discharges to the sea

6.3.1 Removal of seabed installations

It is not planned to allow any discharges into the water from removing the seabed installations which will have a negative impact on the environment. If there should later prove to be a need for significant discharges, a new discharge permit will be applied for and the situation will be handled in compliance with the rules.

We may expect to find marine growth totalling less than 100 tonnes (wet weight) on the steel structure (see section 1.2.1). This represents limited amounts of marine growth, and will not cause any negative impact locally. The marine growth will generally accompany the installations ashore and will be removed from the structures at the reception facility. Some growth may be removed or scraped off during the cutting and lifting work, but the amounts will be small.

Any harmful substances that are present will be mainly removed after the installation has come ashore, so the risk of acute discharges will be low and any discharges will be limited. For this reason, any negative impact from discharges into the sea from the removal of the seabed installations is considered to be “insignificant/none” (see section 6.10.1).

6.3.2 Leaving the entire pipe system in situ (1)

It is planned to clean the pipe system belonging to the Rev field as described in section 2.1.3. All pipes will be cleaned before being left with open ends to accelerate natural decay. Any discharges resulting from the cleaning operations will however be subject to a discharge permit from the Norwegian Environment Agency, and are not covered by the present impact assessment. After cleaning, it is possible that some traces of oil will remain in the pipes, which could cause negligible discharges over 10-30 years before all soluble and easily degradable hydrocarbons have been released.

Pipes and cables left *in situ* will be subject to degradation over time. This is usually a very slow process which is affected by a number of different factors, such as the materials used in the pipes and the environment in which they are located /11/. Leakage from the various grades of steel used in flexible pipes is not considered to represent a discernible environmental risk /48/. The outermost layer of the production pipeline and control cable between Rev and Armada is protected with a

coating of plastic. The production pipeline is also corrosion-protected with anodes (GalvAlum III) which will decay first /49/. Gradual leakage from the anodes will ensure that controlled quantities of aluminium are dissolved. When the protective layer has decayed, leakage of metals from the pipe is expected to take place over a period of 300-500 years before the pipe is broken down completely /48/. The plastic materials are assumed to be non-toxic, and mechanical breakdown is expected to take place rather than biodegradation and bioaccumulation /50/.

The production pipeline is buried 1.8 metres beneath the seabed, while the entrenched control cable between Rev and Armada will be back-filled to 1.5 metres below the seabed. The remaining control cables and jumpers on the Rev field are gravel-dumped. As a rule, we can say that the deeper a pipe is buried, the slower it will decay, so the need for stabilisation measures will also decrease /11/. This is mainly due to reduced access to oxygen, and the fact that the pipes will be less exposed to damage to the protective coating. The biological action of the metals will also be limited when the pipe is buried, and quite limited for the control cables and jumpers which are gravel-dumped.

The seabed sediment in the area consists of compact sand. The low level of TOMs in the sediment indicates that the current in the area is strong enough to carry off any organic material that sinks to the bottom. However, even the compact sediment is not subject to any significant erosion /9/ and so forms a good covering layer over the production pipe. For this reason, erosion is not expected to be a problem with regard to the gas pipeline.

Environmental monitoring will take place as part of the regular environmental monitoring in Region II. Environmental monitoring studies will be conducted at three-year intervals after the installation has been removed, in accordance with Sections 52 and 54 of the Norwegian Activity Regulation and the Guidelines for environmental monitoring after decommissioning of offshore operations (Norwegian Environment Agency, TA-2848). The number of environmental monitoring studies of the Rev field will be assessed in consultation with the Norwegian Environment Agency.

Based on what has been described in this section, the total impact from discharges into the sea from the decay of pipes left *in situ* is considered to be “insignificant/none” (see section 6.10.2).

6.3.3 Removal of the entire pipe system (2)

As described in section 6.3.2, any discharges from the cleaning operations will be subject to a discharge permit from the Norwegian Environment Agency, and are not covered by the present impact assessment. The expected extent of any negative environmental impact caused by discharges into the sea from the removal of the entire pipe system is therefore considered to be “insignificant/none” (see section 6.10.3).

6.3.4 Removing gravel-dumped pipes/cables and leaving buried pipes/control cables in situ (3)

The assessments described in sections 6.3.2 and 6.3.3 will also apply to the removal of gravel-dumped pipes/cables and leaving buried/entrenched pipes/control cables *in situ*.

The expected extent of any negative environmental impact caused by discharges into the sea from removing gravel-dumped pipes/cables and leaving entrenched gas export pipes/control cables *in situ* is therefore considered to be “insignificant/none” (see section 6.10.4).

6.4 Impact on the seabed

6.4.1 Removal of seabed installations

With regard to the removal of the seabed installations, the physical impact on the seabed will come mainly from any dredging work. Dredging may be done with the aid of suction tools or excavators or by washing out with water. The dredging work will cause sediment to be churned up into the water before sinking to the bottom nearby. However, it is assumed that the quantity of churned up sediment will be much less compared to removing platforms.

Monitoring of dredging work from earlier decommissioning operations has shown that the area affected by dredging operations is smaller than previously assumed. The monitoring carried out after the removal of installations on Ekofisk showed that most of the particles settled within a radius of 10-20 metre of the actual dredging operation/51/. Based on this, it is possible to assume that the dredging work prior to removing seabed structures on Rev will cause an area of 10-20 metres from the operation to be affected by sedimentation of stirred up particles. This can also be confirmed by the earlier description of the seabed, which indicates an area of densely packed sand with a little organic material (see section 5.1.2). The particles dug up in connection with dredging will thus be mainly large particles and sand, which will quickly fall to the bottom.

Barges and other vessels used in the removal work may also cause anchor damage to the seabed in a very limited area. However, the sand will be smoothed out in a short time, and the restoration of the seabed is expected to happen relatively quickly. The impact of this physical disturbance is thus expected to be small.

Based on this, the total expected physical impact on the seabed resulting from the removal of seabed installations is considered to be “insignificant/none” (see section 6.10.1).

6.4.2 Leaving the entire pipe system in situ (1)

If the entire pipe system is left *in situ*, only the actual cutting operation and any dredging associated with this will cause any disturbance of the seabed. There will also be some covering of the ends where the pipes/cables have been cut. The physical impact on the seabed resulting from leaving the entire pipe system *in situ* is considered to be “insignificant/none” (see section 6.10.2).

6.4.3 Removal of the entire pipe system (2)

Removing the pipe system connected to the Rev field (including the pipeline/control cable that runs to the Armada field) will demand substantial digging/dredging work, as the pipes are either buried or gravel-dumped. As described in section 6.4.1 this will cause the surrounding sediments to be churned up, with an area of 10-20 metres from the dredging operation assumed to be affected. The geographical extent of the churning up and subsequent settling of mud will therefore be greater than that from removing the seabed structures.

As described in section 6.4.1, the problem with this is mainly mud settling on the seabed and on bottom-living organisms. The organisms with little or no mobility close to the point where the mud is churned up are likely to be the most affected by this. Bottom-living animals are well adapted to a certain degree of particle sedimentation, but they may be badly affected in the area where the most mud settles. However, no vulnerable seabed environments have been found in the Rev area, and the bottom fauna where the mud settlement is most intense is expected to be able to re-establish itself in a few years.

The total extent of the impact caused by the removal of the entire pipe system on the Rev field is considered to be “slightly negative” (see section 6.10.3).

6.4.4 Removing gravel-dumped cables and leaving buried pipes/control cables in situ (3)

Removing the gravel-dumped pipes/cables (including jumpers and control cables on the Rev installations) will demand some digging/dredging work. This will in turn cause surrounding sediments to be churned up. As described in section 6.4.1 it is assumed that an area of 10-20 metres from the dredging operation will be affected in the form of sedimentation of stirred up particles. However, the removal of these pipes represents an impact on a small area, and the area potentially affected by sedimentation is therefore considered to be limited.

The total extent of the impact caused by the removal of gravel-dumped pipes/cables and leaving buried pipes/control cables *in situ* is considered to be “slightly negative” (see section 6.10.4).

6.5 Spread of contaminants

6.5.1 Removal of seabed installations

As described earlier (see section 6.4) dredging in connection with the removal of seabed installations could affect the seabed, including churning up sediment. Both water and oil-based drill cuttings have been generated during the drilling processes on the Rev field; see section 5.1.2. As the wells on the Rev field were drilled after the ban on discharges of oil-based cuttings came into force, there have been no discharges of oil-based cuttings. The estimated volume of water-based cuttings discharged in the period 2006-2012 is approx. 3,400 tonnes. It is planned to carry out a site survey in the vicinity of the Rev installation to identify any heaps of drill cuttings.

Based on results from the environmental analysis carried out in the region in 2012 the environmental status of the Rev field is generally considered to be good; see section 5.1.2. An analysis of THC in the sediment samples at the various measurement stations around the Rev field shows an average concentration of 2 mg/kg, with maximum and minimum concentrations of 3 mg/kg and 1 mg/kg. The highest concentrations are at the measurement points 500 metres from the Rev installation. These are nevertheless below the Norwegian Oil and Gas Association guideline values of 50 mg/kg of THCs and so do not call for any further analyses /48/.

Among the metal concentrations, it is barium that stands out. Only two of the measurement stations are below the LSC of 31 mg/kg. The others average over 58 mg/kg, with highest and lowest values of 160 mg/kg and 35 mg/kg. The barium results are higher than the regional station R2-15 (25 mg/kg Ba). High barium values mainly result from the use of barite ($BaSO_4$) as a weighting agent in various types of drilling mud.

Although barium has the potential to accumulate in aquatic organisms, the metal generally constitutes a low environmental risk. This is because the metal has a strong tendency to form insoluble salts that have limited biological action. The metal is therefore expected to occur in its original form (from the source barite) or to form insoluble salts. The spread of sediment contaminated with barium is not therefore seen as a significant environmental risk (see section 6.10).

The spread of contaminated sediment from the removal of seabed installations is therefore considered to have “insignificant/no” impact overall (see section 6.10.1).

6.5.2 Leaving the entire pipe system in situ (1)

If the buried/gravel-dumped pipes/cables are left *in situ*, only the actual cutting operation and any dredging associated with this will cause any disturbance of the seabed and contaminated sediment. Negative consequences of the spread of contaminated sediment are thus considered to be “insignificant/none” (including 6.10.2).

6.5.3 Removing the entire pipe system (2)

As described in section 6.4.3 the removal of the gravel-dumped/buried pipes/cables will require significant digging/dredging work prior to the actual removal operation, which will cause sediment and particles to be churned up. Given the contamination status of the Rev and Armada fields, negative consequences of the spread of contaminated sediment are however considered to be “insignificant/none” (see section 6.10.3).

6.5.4 Removing gravel-dumped pipes/cables and leaving buried pipes/control cables in situ (3)

The removal of jumpers and control cables linked to the Rev installations will demand a lot of digging/dredging work prior to the actual removal operation, as they are gravel-dumped. As described earlier (see section 6.4) this will cause sediment and particles to be churned up. Given the contamination status of the Rev field, negative consequences of the spread of contaminated sediment are however considered to be “insignificant/none” (see section 6.10.4).

6.6 Impact on biota

This chapter discusses the impact of the measure on biota. In this case, biota refers to organisms and groups of organisms that may be affected, specifically various species of fish, seabirds, marine mammals, benthic organisms and organisms in the pelagic system (see section 5.1 for a description of these species and groups of organisms).

6.6.1 Plankton

The organisms in the pelagic system are often very vulnerable to various impacts/emissions of chemicals, oil and oil components. No large quantities of chemicals or oil are expected to be discharged during the work of removing the installations. If there are nevertheless emissions of such chemicals, oil or biocides, the volume in the bodies of water in the area affected will be so small that the impact on biota in the pelagic system will be “insignificant/none”.

6.6.2 Benthic zone

In connection with the various dredging activities involved in removing seabed installations, there will be some stirring up and subsequent re-sedimentation of particles (see section 6.4 for details). If pipes/cables are removed (options 2 and 3) there will be further dredging work which will extend over a large area. There is then a strong possibility of sedimentation completely or partially burying bottom fauna in parts of this area. Many of the bottom-living species are however mobile and well adapted to a certain degree of particle sedimentation, which makes them more tolerant of mud settling. The bottom-living species are also generally well able to re-establish themselves in an area, and where the disturbance is greatest, the bottom fauna will be able to re-establish itself in a few years. The area affected will also be relatively small. It should also be mentioned that no vulnerable seabed environment has been found in the Rev area (or the Armada area). Based on this, the overall impact on biota in the benthic zone is considered to be “insignificant/none”.

6.6.3 Fish

In the project area there are expected to be several pelagic species such as herring and sprat in addition to benthic species including various types of flatfish, cod and haddock (see section 5.1.5). All of these species may be affected by various emissions such as chemicals and oil, and the effects of sediments stirred up and re-settling. However, fish are generally very mobile, and it may be assumed that any fish in the affected area will move out if the conditions are not favourable.

Based on this, we may expect “insignificant/no” impact on the various species of fish from the measure.

6.6.4 Seabirds and marine mammals

Seabirds and marine mammals could be affected by the work of removing the Rev installations in the sense that these groups may be frightened away from the area by noise, light and the presence of vessels. However, any such impact will be geographically limited, and the limited time will ensure that the impact of the measure on these groups of animals is insignificant. Individual species of seabirds may also be attracted by the activity, and look for food concentrated by the light and in the lee of the structures.

The overall impact on biota will be “insignificant/none” as a result of the activities to remove the Rev installations (see section 6.10).

6.7 Littering

Waste taken ashore will be handled in accordance with rules that prevent and restrict any negative effects from the waste, including littering. The seabed installations will secured against falling objects while they are lifted and transported ashore. In this connection, any littering will therefore be mainly littering of the sea. Littering is thus mainly to do with leaving/depositing something on the seabed that was not there before the operation started, and not generally relevant to report for the removal options.

Cleaning up or disposing of the field is mandatory and so it is not expected that the removal of seabed installations and associated pipes/cables (options 2 and 3) will cause littering. For this reason there will not be any impact in terms of littering from removing seabed installations and associated pipes/cables, so only the options of leaving pipes/cables *in situ* (options 1 and 3) will be examined further.

Leaving pipes/cables *in situ* (options 1 and 3) is not generally expected to have any negative impact in terms of littering the seabed. The pipe/cables left *in situ* will be sufficiently buried/covered up and any exposed pipe ends will be either removed, buried or covered over. It is also assumed that the pipes/cables will be undisturbed by any physical effects (anchors, trawls etc.). Natural decay of the pipes/cables will normally take hundreds of years, but if they are damaged, the decomposition process will go faster /11/. Based on this, and the fact that leaving the pipes/cables *in situ* has a lasting and irreversible impact, the negative environmental consequences of littering from leaving pipes/cables on the Rev field and between Rev and Armada are considered to be “slightly negative” (see sections 6.10.2 and 6.10.4).

6.8 Aesthetic impact of the reception facility

The aesthetic impact of reception facilities is only relevant with regard to removal, including seabed installations and pipes/cables (options 2 and 3). The location for receiving and cutting up will not be known until after the decommissioning plan has been approved. The consequences are therefore based only on the knowledge that we have of the installation, and general assessments of relevant locations (see section 2.4). ROV studies undertaken in 2012–2013 showed localised slight hard growth of marine organisms on the seabed installations. No precise calculations have been made of the total weight of marine growth on the seabed installations, but it is expected to be less than 100 tonnes (wet weight). Marine growth is most often removed on land, either by mechanical means or with high-pressure hoses. Marine growth accompanying the seabed installations ashore will normally be removed, sent to an approved location for such waste and composted. It is assumed that this process will take place as quickly as practically possible to reduce the odour problem to a minimum.

No negative impact is expected from visual disturbances associated with the handling of the Rev installations and pipes/cables at the reception facility itself as these are located in areas already designated for industrial use.

Noise can be a problem with this type of industry. This includes noise from clipping and cutting metal, high-pressure hoses and machine activity. A permit to operate such a facility requires a noise map to be produced in the regulatory process for the site. The permit for the facility will also include noise limits etc.

Overall, the aesthetic impact of cutting up work at the reception facility is considered to be “insignificant/none” for the removal options (see sections 6.10.1, 6.10.3 and 6.10.4). Depending on the place and time of the cutting operation, preventive measures will be implemented to minimise the impact of activities at the reception facility.

6.9 Materials, waste management and resource utilisation

The installations and associated infrastructure could potentially contain substances that might be harmful to health and/or the environment. There will be an analysis of possible radioactive substances and other contaminants both in the planning phase and after production has ceased. Refer to NORSOK standard S-003 /7/.

When the Rev installations reach the reception facility, wherever possible, hazardous waste will be dealt with and removed before cutting up starts. Materials that cannot be re-used will be recycled, and any remaining waste will be processed in line with the rules.

With the removal of the Rev installations, the total amount of materials to be handled on land is estimated at 290 tonnes (option 1). These are installations made mainly of recyclable steel (approx. 96–98%) which can be cut up and melted down. Recycling of steel is regarded as a slightly positive effect, as the production of new steel is more resource-consuming.

For the options involving removal of pipes/cables, the total amount of Rev materials to be handled on land is estimated at approx. 1260 tonnes and 470 tonnes for options 2 and 3 respectively. As well as steel, the flexible pipes also contain plastic materials. It is possible to re-use the pipes, but preferably for a similar application to that which they were originally designed for. It is most likely that steel and plastic will be separated and sent for recycling. The production of new steel is three times more resource-hungry than recycling. Recycling of steel and plastic from the pipes is seen as a slightly positive consequence. The concrete mattresses used to cover some pipes are expected to be removed for handling on land, unless they have a stabilising effect on buried pipes that are to be left *in situ*. The concrete can be used as rubble or added to new concrete (replacing sand or gravel). Leaving pipes/cables *in situ* (options 1 and 3) is considered to have a “slightly negative” impact in terms of resource utilisation.

See section 6.10 for the overall evaluation of the different options.

6.10 Summary of environmental impact

The tables presented in sections 6.10.1, 6.10.2, 6.10.3 and 6.10.4 show the impact matrix which has been used, along with the descriptions in sections 6.3–6.9, for the impact analyses assessed in relation to ceasing operations and removing installations on the Rev field. Refer to section 4.2 for the definitions behind the different classifications used in the tables below. A brief summary of the results is given in section 8.

6.10.1 Removal of seabed installations

Table 16 shows the environmental consequences of the recommended disposal solution for the seabed installations, including removal. The category of “littering” is not considered to apply to the removal of the seabed installations, as it is planned to remove the entire structure so there will be no littering associated with this activity. Any lost units will be removed and transported ashore for further processing.

Table 16. Environmental impact of the recommended disposal solution for decommissioning and disposing of seabed installations (removal)

Impact matrix for the recommended disposal solution for decommissioning and disposing of seabed installations		**Discharges to the sea**	**Impact on the seabed**	**Spread of contaminants**	**Impact on biota**	**Littering**	**Aesthetic impact at the reception facility**	**Waste management and resource utilisation**
Nature of the impact	Positive							X
	Negative	X	X	X	X		X	
Type of impact	Direct	X	X	X	X		X	X
	Indirect							
	Secondary							
	Cumulative							
Degree of reversibility	Reversible	X	X	X	X		X	X
	Irreversible							
Importance/vulnerability of resources	Low	X	X	X	X		N/A	
	Medium							X
	Large							
Intensity of impact	Insignificant/none	X	X	X	X		X	
	Small							X
	Medium							
	Large							
Geographical extent of impact	Local	X	X	X	X		X	X
	Regional							
	National							
	International							
Duration of impact	Immediate	X	X	X			X	X
	Short-term							
	Medium				X			
	Long-term							
Total impact		Insignificant/ none	Insignificant/ none	Insignificant/ none	Insignificant/ none*	N/A	Insignificant /none	Slightly positive

* “Mean duration of impact” mostly refers to biota on the seabed. After churning up and re-sedimentation, it is assumed that it will take more than a year to restore the area. The geographical extent will nevertheless be minimal, so the total impact is considered to be “insignificant/none”.

6.10.2 Leaving the entire pipe system (1)

Table 17 shows the environmental impact of leaving all pipes and cables associated with the Rev field *in situ*. As with seabed installations, littering is not considered relevant to this activity. Any lost units will be removed and transported ashore for further processing.

Table 17. Environmental impact of leaving all pipes and cables *in situ* (option 1).

Impact matrix for leaving all pipes and cables *in situ* (option 1)		Discharges to the sea	Impact on the seabed	Spread of contaminants	Impact on biota	Littering	Aesthetic impact at the reception facility	Waste management and resource utilisation
Nature of the impact	Positive						N/A	
	Negative	X	X	X	X	X		X
Type of impact	Direct	X	X	X	X	X		X
	Indirect							
	Secondary							
	Cumulative							
Degree of reversibility	Reversible	X	X	X	X			
	Irreversible					X		X
Importance/vulnerability of resources	Low	X	X	X	X	X		
	Medium							X
	Large							
Intensity of impact	Insignificant/none	X	X	X	X	X		N/A
	Small							
	Medium							
	Large							
Geographical extent of impact*	Local	X	X	X	X			
	Regional							
	National							
	International					X		
Duration of impact	Immediate		X	X	X			
	Short-term							
	Medium							
	Long-term	X				X		
Total impact		Insignificant/ none**	Insignificant/ none	Insignificant/ none***	Insignificant/ none	Slightly negative	N/A	Slightly negative

* Consequences of “discharges to the sea”, “impact on the seabed”, “spread of contaminants” and “impact on biota” may also be seen as international as the pipeline extends into the UK sector. The impact related to this specific section of pipeline will nevertheless be of a local nature.

** For discharges to the sea, the impact is given as long-term, but as described in section 6.3.2, the impact of emissions of very small amounts of soluble hydrocarbons will be “insignificant/none”.

*** In the long term we may expect some insignificant leakage of pollutants as the pipe corrodes.

6.10.3 Removal of all pipes and cables (2)

Table 18 shows the environmental impact of removing all pipes and cables associated with the Rev field. As for the seabed installations, littering is not considered relevant to this activity. Any lost units will be removed and transported ashore for further processing.

Table 18. Environmental impact of removing all pipes and cables (option 2)

Impact matrix for the removal of all pipes and cables		Discharges to the sea	Impact on the seabed	Spread of contaminants	Impact on biota	Littering	Aesthetic impact at the reception facility	Waste management and resource utilisation
Nature of the impact	Positive							X
	Negative	X	X	X	X		X	
Type of impact	Direct	X	X	X	X		X	X
	Indirect							
	Secondary							
	Cumulative							
Degree of reversibility	Reversible	X	X	X	X		X	X
	Irreversible							
Importance/vulnerability of resources	Low	X	X	X	X		N/A	
	Medium							X
	Large							
Intensity of impact	Insignificant/none	X		X	X		X	X
	Small		X					
	Medium							
	Large							
Geographical extent of impact*	Local	X	X	X	X		X	X
	Regional							
	National							
	International							
Duration of impact	Immediate	X		X			X	X
	Short-term							
	Medium		X		X			
	Long-term							
Total impact		Insignificant/ none	Slightly negative	Insignificant/ none	Insignificant/ none**	N/A	Insignificant /none	Slightly positive

* Consequences of “discharges to the sea”, “impact on the seabed”, “spread of contaminants” and “impact on biota” may also be seen as international as the pipeline extends into the UK sector. The impact related to a specific section of pipeline will nevertheless be of a local nature.

** “Mean duration of impact” mostly refers to biota on the seabed. After churning up and re-sedimentation, it is assumed that it will take more than a year to restore the area. The geographical extent will nevertheless be minimal, so the total impact is considered to be “insignificant/none”.

6.10.4 Removing gravel-dumped pipes/cables and leaving buried pipes/control cables in situ (3)

Table 19 shows the environmental impact of removing gravel-dumped pipes/cables and leaving buried pipes/control cables *in situ*.

Table 19. Environmental impact of removing gravel-dumped pipes/cables and leaving buried pipes/control cables *in situ*

Impact matrix for removing gravel-dumped pipes/cables and leaving buried pipes/control cables *in situ*		**Discharges to the sea**	**Impact on the seabed**	**Spread of contaminants**	**Impact on biota**	**Littering**	**Aesthetic impact at the reception facility**	**Waste management and resource utilisation ******
Nature of the impact	Positive							X
	Negative	X	X	X	X	X	X	X
Type of impact	Direct	X	X	X	X	X	X	X
	Indirect							
	Secondary							
	Cumulative							
Degree of reversibility	Reversible	X	X	X	X		X	
	Irreversible					X		X
Importance/vulnerability of resources	Low	X	X	X	X	X	N/A	
	Medium							X
	Large							
Intensity of impact	Insignificant/none	X	X	X	X	X	X	X
	Small							
	Medium							
	Large							
Geographical extent of impact*	Local	X	X	X	X		X	X
	Regional							
	National							
	International					X		
Duration of impact	Immediate			X			X	x
	Short-term							
	Medium		X		X			
	Long-term	X				X		
Total impact		Insignificant/ none	Slightly negative	Insignificant/ none**	Insignificant/ none***	Slightly negative	Insignificant /none	Slightly positive Slightly negative

* Consequences of “discharges to the sea”, “impact on the seabed”, “spread of contaminants” and “impact on biota” may also be seen as international as the pipeline extends into the UK sector. The impact related to a specific section of pipeline will nevertheless be of a local nature.

** In the long term we may expect some insignificant leakage of pollutants as the pipe corrodes.

*** “Mean duration of impact” mostly refers to biota on the seabed. After churning up and re-sedimentation, it is assumed that it will take more than a year to restore the area. The geographical extent will nevertheless be minimal, so the total impact is considered to be “insignificant/none”.

**** The intensity, geographical extent and duration of the effects here refer to pipes that are removed. These aspects are not relevant to pipes left *in situ*. Overall, there will be a “slightly negative” impact from leaving pipes *in situ*, while there will be a “slightly positive” impact for the pipes that are removed in terms of resource utilisation.

7 Social impact

7.1 Fishing

As shown in section 5.2.2 Rev is not located in the busiest fishing areas. However, a large amount of fishing has been recorded to the east of Rev. The intensity of fishing varies from year to year, and it is mainly in the 2nd and 3rd quarters that activity is greatest. In the 1st quarter there is very little fishing, while the 4th quarter sees more widespread fishing on both the Norwegian and UK sides of Rev.

During the process of removing the Rev installations, large and small vessels will be positioned to play various roles in plugging the wells and the removal work. In this period there will be shipping in the area, including vessels that are not manoeuvrable. It may be assumed that these vessels will not be a practical obstacle to fishing in the area. In connection with removing/covering the pipe system there will also be vessels in the area that could constitute an obstacle to fishing. This will however be for a limited period.

The seabed installations are over-trawlable and should not cause an obstacle to fishing. Removing them is nevertheless seen as positive. With the exception of the project period, removing the installation and any pipes/cables (options 2 and 3) is considered to have a “slightly positive” impact on fishing. For the options of leaving the pipes *in situ* (options 1 and 3), the pipes will be cut at the ends and any pipe ends that could impede other activities will be covered or buried. Any concrete mattresses covering the pipes could also be broken by repeated over-trawling, and steel reinforcement and fragments of concrete could be a hindrance to trawling. As a rule, therefore, it is planned to remove concrete mattresses. In cases where the concrete mattresses have a stabilising effect on buried pipes that are to be left *in situ*, these concrete mattresses may also be left *in situ*.

Gravel-dumped pipes and cables may be exposed over time if trawling activity, for example, gradually removes the gravel-dumping over the years. The removal of gravel-dumped pipes (option 3) and subsequent smoothing of the seabed will eliminate such potential obstacles to fishing.

The route is expected to be surveyed with ROV to ensure that all parts of the pipe are covered over and do not constitute a hindrance to fishing. This will reduce any risk of potential future exposure of gravel-dumped pipes. The potential leaving *in situ* of pipes/cables (option 1) is therefore considered to have “insignificant/no” impact.

7.2 Aquaculture

Aquaculture is an industry which is closely tied to the coastal areas, so there will be no requirements related to this issue before the installations/pipes are transported to a processing plant. From past experience, the requirements will then relate to closing off areas and the effects of pollution, including noise. The degree of impact will depend on the position of the processing facility in relation to the aquaculture facility, activities at the processing facility and the associated noise and vibration generated.

As stated earlier, it has not yet been decided which scrapping location should be used for final disposal of the Rev installations (see section 2.4 for possible processing facilities). Any possible impact from cutting up is however expected to be covered by the facility's permits.

7.3 Shipping

Shipping in the North Sea is described in section 5.2.3. In practice, a 500 metre safety zone has been established around all installations in North Sea, within which all vessels are prohibited apart from those which the operator has authorised to enter the zone. Rev comprises underwater installations only, and therefore has no safety zone for shipping.

During the process of removing the Rev installations, large and small vessels will be positioned to play various roles in the removal work. It may be assumed that these vessels will not be a practical obstacle to shipping in the area.

In the event of removal/covering of pipes/cables, vessels may be positioned along the route of the pipe. It is expected that such vessels will not be manoeuvrable at certain times but will have sufficient signals to mark their presence. It may be assumed that these vessels will not be a practical obstacle to other shipping and navigation.

7.4 Historic monuments

There are no known historic monuments/shipwrecks in the vicinity of the Rev installations or the project area (see Figure 19). The Directorate for Cultural Heritage defines the most interesting historic monuments from the petroleum industry, with A as the highest priority and D as the lowest. In this context, Rev has been assigned priority D, the lowest ranking, so it is not recommended that the field should be the subject of thorough documentation.

It is however of great importance to general knowledge of activities on the continental shelf that some documents should be retained from all fields that have been in production. This mainly involves photographs and film, general construction drawings and high-level operational documentation (operating manuals). These documents are looked after and organised by the Norwegian Petroleum Museum and stored in the National Library in Mo i Rana and in the State Archives in Stavanger. The Norwegian Petroleum Museum will have access to the desired documentation to the extent that it is considered possible to supply it to the museum.

For scheduled surveys, it is planned to make contact with the historic monuments administration beforehand, so they can assist in the planning and possibly in inspections to identify any historic monuments. If any ship finds are discovered during the work of removal, they must be reported to the Directorate for Cultural Heritage; cf. Cultural Heritage Act, Section 14 third paragraph.

7.5 Costs, employment and national provision of goods and services

The work of removing the Rev installations may have a limited effect on employment at the national level, depending on who is awarded the various contracts. The extended effects on employment will be modest because of the modest size and complexity of Rev.
No detailed calculations have been made of the effects of Rev on employment, but based on earlier experience with this type of project, many players may be involved, mainly at the national, regional and local levels. Table 20 below shows examples of different parties who are normally involved in a project of this kind, and the roles they play in the process.

Table 20. Examples of parties that may be involved in a project of this kind

Type of process	Role
Supply and anchoring vessels	Offshore operation
Waste management	Handling of hazardous waste, organic marine waste and other waste
Melting down / recycling	Recycling of steel structures
Transport	Boat transport offshore, onshore transport
Consultants	Studies (technical, environmental, economic etc.)
Bureaucracy	Permits

Project management and planning will usually be handled by the company itself, possibly supported by local suppliers, which means that the Norwegian share of the employees is likely to be high (>70%).

For the cutting up activity on land, the level of employment will depend on the location chosen. The effect on employment of the cutting up work will be either entirely Norwegian or entirely foreign. Moreover, the effect on employment in the scrapping location will in practice be to maintain/continue the activity and not to start a new one. The first removal projects on the Norwegian continental shelf were in 1996 (Northeast Frigg and Odin). Since then, decommissioning projects have been an intermittent activity. This maintenance of employment and greater continuity are seen as positive in terms of skills development and stability at the local level.

No detailed analyses have been carried out of the social impact of the removal and final disposal of Rev.

The total costs of option 1 (base case) come to approx. NOK 800 million (2014) and are presented in Table 21. The calculations are based on removing seabed structures and leaving all pipes *in situ*. The reference option of removing all pipes (2) is expected to entail a significant increase in costs. However, the cost estimate for this solution is rather uncertain, and will depend on the method of removal etc. The same is true of the removal of gravel-dumped pipes and leaving buried pipes *in situ* (3), but in this case, the pipes are relatively short (100–600 metres), so the costs are expected to be lower than for option 2.

Table 21. Estimated costs of removing seabed installations, pipes and control cables

Operation	Total costs (NOK millions)
Planning, project control etc.	37
Plugging of wells	593
Removal of seabed structures	139
Other	29
Total estimate	**798**

8 Comparison of impacts

This chapter briefly summarises the impact on the environment and society of winding up the operation and disposing of the installations on the Rev field. Estimated energy consumption and emissions into the air (CO_2, NO_x and SO_2) for the different disposal solutions are given in Table 22. The consequences of removing seabed installations are shown in Figure 28. The consequences of the different alternative disposal solutions for the pipes/cables connected to the Rev field are shown in Figure 29, Figure 30 and Figure 31. The final assessment of these options is given in section 8.6.

8.1 Energy consumption and emissions into the air

Estimated energy consumption and emissions into the air for the different disposal solutions are presented in Table 22. According to the proposed impact scale from the Norwegian Oil and Gas Association for energy consumption for offshore decommissioning /22/ the energy consumption for option 2 (removal of seabed installations and the entire pipe system) is considered to fall within the impact category “slightly negative”. On the other hand, options 1 (removal of seabed installations and leaving the entire pipe system *in situ*) and 3 (removal of seabed installations and gravel-dumped pipes/cables, leaving buried pipes/cables *in situ*) fall into the impact category “insignificant/none”.

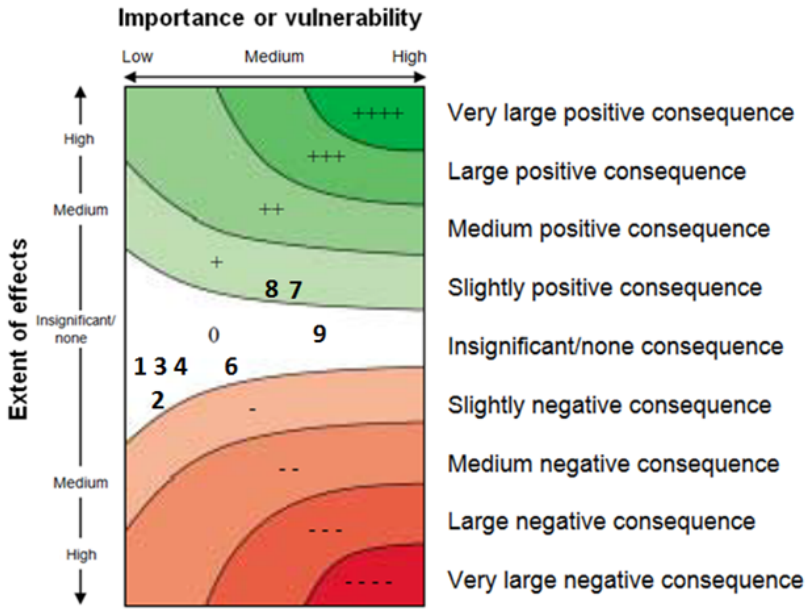
Table 22. Estimated energy consumption and emissions into the air for the different options

Resource	Removal of seabed installations and leaving the entire pipe system *in situ* (1)	Removal of seabed installations and the entire pipe system (2)	Removal of seabed installations and gravel-dumped pipes/cables, leaving buried pipes/control cables *in situ* (3)
Energy consumption (GJ)	58,000	109,000	60,000
CO_2 emissions (tonnes)	4,400	8,300	4,600
NO_x emissions (tonnes)	50	140	50
SO_2 emissions (tonnes)	15	30	16

The scale of emissions from decommissioning the Rev field is relatively modest when taken in isolation but, together with other sources, could contribute to negative environmental consequences. The challenge will therefore be to carry out the various operations in the most energy-saving way possible, so as to minimise emissions into the air.

8.2 Removal of seabed installations

Figure 28 shows the environmental and social effects of decommissioning and disposing of the Rev installations.



Discharge to the sea	1
Impact on the seabed	2
Spread of contaminants	3
Impact on biota	4
Littering	N/A
Aesthetic impacts at the reception facility	6
Waste management / resource utilisation	7
Fishing	8
Shipping	9

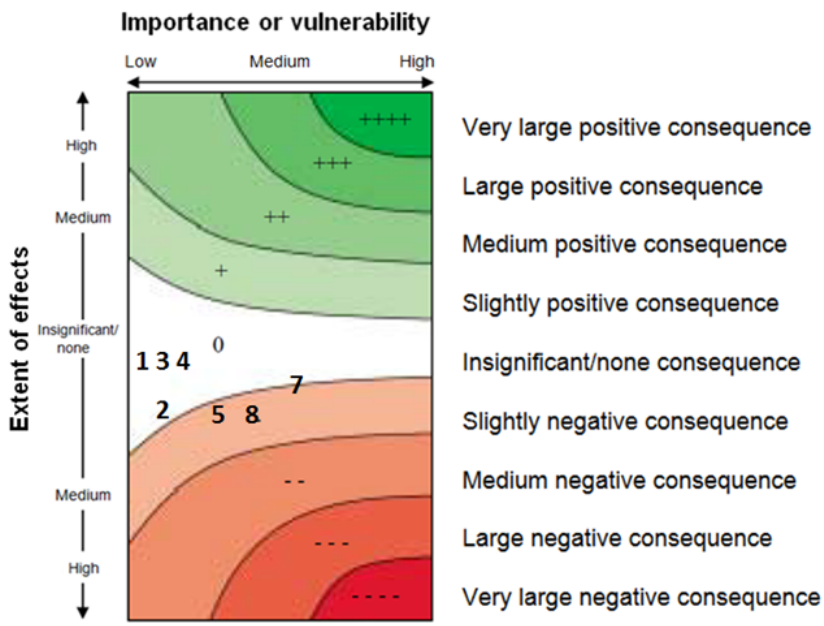
Figure 28. Impact matrix for recommended disposal solution for Rev seabed installations, including removal

As can be seen from the diagram, the consequences of discharges to the sea, impact on the seabed, spreading of contaminants, effects on biota, and the aesthetic impact of the reception facility are considered to be “insignificant/none”. This is because the impact will be geographically limited and of brief duration, and any discharges and effects on the water column/seabed will be limited in terms of volume and will be restored after a relatively short time. At the reception facility too, the activities will be limited in duration, and the effects of noise, visual disturbances etc. will not be relevant as they are assumed to be covered by the facility’s general operating permit.

For shipping, the impact of the removal work is rated “insignificant/none”, as it is expected that the vessels involved will not be a practical hindrance to shipping in the area. Although the seabed installations are over-trawlable, removal is felt to have a “slightly positive” impact on fishing. This is because it eliminates potential future conflicts with fishing, and the work of removal will not require a larger safety zone than there is at present. For waste management and resource utilisation, the consequences of removing the Rev seabed installations are rated “slightly negative”. Waste management and resource utilisation will have a positive effect on employment, and the recycling of waste and metals will be positive compared to producing new energy and new metal.

8.3 Leaving the entire pipe system in situ (1)

Figure 29 shows the environmental and social effects of leaving the entire pipe system on the Rev field *in situ*.



Discharge to the sea	1
Impact on the seabed	2
Spread of contaminants	3
Impact on biota	4
Littering	5
Aesthetic impacts at the reception facility	N/A
Waste management / resource utilisation	7
Fishing	8
Shipping	N/A

Figure 29. Impact matrix for leaving the entire pipe system *in situ*

As with the seabed installations, the impact of discharges to the sea, effect on the seabed, effects on biota and spreading of contaminants is considered to be “insignificant/none” for all pipes/cables. It should be stressed that churning up and re-sedimentation from cutting pipe ends will be much less than with options 2 and 3.

Leaving pipes *in situ* is considered less technically challenging and so constitutes less of a safety risk than complete removal (option 2) /8/. The total energy consumption and emissions into the air and the marine environment are also lower if the fixtures are left on the seabed. There will also be relatively large costs associated with removing the gravel-dumped and buried pipes compared with leaving them *in situ*.

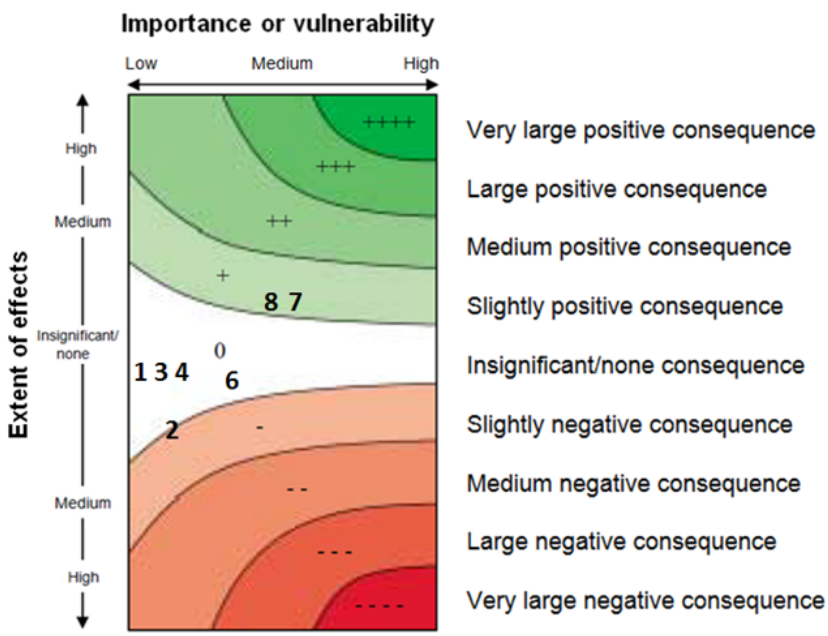
For littering, waste management and resource utilisation, and fishing, the consequences of leaving the pipelines in place are rated “slightly negative”. The reason for this is that pipes that are left *in situ* are defined as abandoned waste, and it will require more energy to produce new steel compared to potential recycling if they are removed. Moreover, leaving the pipes *in situ* could potentially conflict with fishing, but if preventive measures are taken to ensure that the pipes are adequately covered, the interests of fishing are considered to be safeguarded (see section 9).

It should also be emphasised that the pipes are properly covered, and there is little trawling activity in the area concerned. To prevent snagging of fishing gear, any exposed sections of pipe will be rock-dumped, or possibly cut off and taken ashore for final disposal. It is therefore not expected that

leaving these pipes *in situ* will have a negative impact on fishing. According to Storting white paper no 47 (1999-2000), fishing interests are considered to have been safeguarded if the pipes or cables are or will be properly covered or buried /3/. According to DECC guidelines, pipes that are adequately buried/entrenched are regarded as candidates for leaving *in situ*. This is subject to an assessment to establish that no exposed sections will develop and that the state of the pipe (adequately buried/entrenched) will persist /6/. When the work is finished, an inspection will be conducted to ensure that the pipes are not considered to constitute a possible hindrance to fishing in the future.

8.4 Removal of the entire pipe system (2)

Figure 30 shows the environmental and social effects of removing the entire pipe system on the Rev field.



Discharge to the sea	1
Impact on the seabed	2
Spread of contaminants	3
Impact on biota	4
Littering	N/A
Aesthetic impacts at the reception facility	6
Waste management / resource utilisation	7
Fishing	8
Shipping	N/A

Figure 30. Impact matrix for removing the entire pipe system

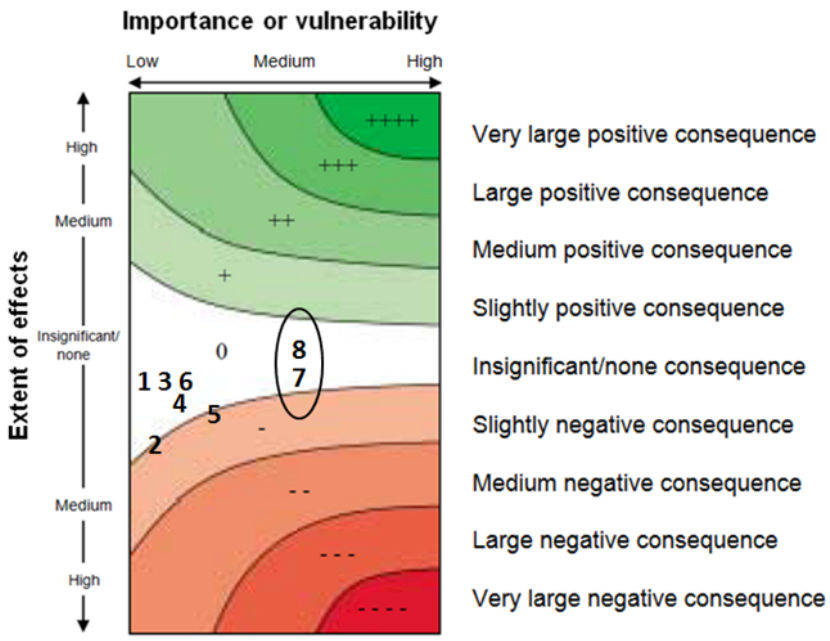
As can be seen from the diagram, discharges to the sea, impact on the seabed, spreading of contaminants, effects on biota, and the aesthetic impact of the reception facility are considered to be “insignificant/none” if all pipes are removed. The impact on the seabed is also considered to be “slightly negative”, while the effects on waste management and resource utilisation, and fishing, are considered to be “slightly positive”. The assessments behind this view are in line with the descriptions given for the seabed installations.

The removal option is regarded as a technically very challenging alternative, with a greater risk to personnel from handling pipes on deck /8/. Despite cleaning pipes used to carry hydrocarbons,

there is always a risk of personnel on board ships being exposed to hazardous vapours from open pipes. Handling pipes is also a known source of crushing and impact injuries. There is also an enhanced risk to the costs and schedule compared to leaving *in situ*. This option involves greater disturbance to the seabed as the removal operation demands extensive preparatory dredging work. On the other hand, the impact on fishing is considered to be positive as the pipes will be removed from the seabed, thus eliminating any risk of potential future exposure of gravel-dumped pipes.

8.5 Removing gravel-dumped pipes/cables and leaving buried pipes/control cables in situ (3)

Figure 31 shows the environmental and social impact of removing gravel-dumped pipes/cables and leaving buried pipes/control cables *in situ*.



Discharge to the sea	1
Impact on the seabed	2
Spread of contaminants	3
Impact on biota	4
Littering	5
Aesthetic impacts at the reception facility	6
Waste management / resource utilisation	7
Fishing	8
Shipping	N/A

Figure 31. Impact matrix for removing gravel-dumped pipes/cables and leaving buried pipes/control cables *in situ*

It can be seen from the figure that discharges to the sea, spreading of contaminants and effects on biota are considered to have “insignificant/no” impact. This is because any discharges and effects on the water column from removing gravel-dumped pipes/cables will be limited in terms of volume and will be restored after a relatively short time. For the production pipeline left *in situ*, we may expect some insignificant leakage of pollutants over time as the pipe corrodes. At the reception facility too, the activities will be limited in duration, and the effects of noise, visual disturbances etc. will not be relevant as they are assumed to be covered by the facility’s general operating permit.

Removing the gravel-dumped pipes/cables will have a “slightly positive” impact on fishing as the potential for future conflict will be eliminated. Conversely, leaving the buried pipe and control cable *in situ* is considered to have a “slightly negative” impact, as it could potentially conflict with fishing. As described in section 8.3, the interests of fishing are considered to be safeguarded if preventive measures are taken to ensure that the pipes are adequately covered (see section 9).

The removal of the gravel-dumped pipes/cables is a technically demanding job /8/ which calls for extensive preparatory work, including dredging and removal of rocks. These activities will pose a greater risk to personnel and cause great disturbance to the seabed. This option is also seen as a greater risk to the costs and schedule compared to leaving *in situ*.

For waste management and resource usage, leaving the pipe/control cable *in situ* is considered to have a “slightly negative” impact, given that the production of an equivalent amount of material will require more energy than removal and recycling. The removal of gravel-dumped pipes/cables will have a “slightly positive” impact in terms of waste management and resource usage.

8.6 Recommended decommissioning option

It is planned to completely remove the seabed installations associated with the Rev field. It is felt that removing the Rev installations will be a positive measure for social interests such as land-based industry and fishing. Around the scrapping facility, the decommissioning project can help to maintain continued operation and may make a significant contribution to extended local effects. Although the seabed installations are over-trawlable, removal is felt to have a “slightly positive” impact on fishing, as it eliminates potential future conflicts with fishing.

It will also be positive for the environment when activity on the field stops, although there may be minor negative consequences while the removal work is in progress, particularly with regard to the seabed in the vicinity of the installation. The physical impact on the seabed will be very localised and limited to the area already affected. It will also be positive in energy terms as most of the materials from the installations are expected to be recyclable. Hazardous waste will be dealt with and processed in accordance with industry practice.

For the pipelines connected to the Rev field, various options have been evaluated. Of these, option 2 (removal of the entire pipe system) emerges as the least advantageous option. The difference between options 1 and 3 is whether the gravel-dumped pipes and cables on the Rev field should be left *in situ* or removed. For both options, on the other hand, buried pipes and cables between the Rev field and the Armada field will be left *in situ*.

The usual practice on the continental shelf is that pipes and cables that are adequately buried/gravel-dumped can normally be left in place. Refer to Storting white paper no 47 (1999-2000), which says that, as a general rule, permission should be given for pipes and cables to be left in place where they do not cause inconvenience or constitute a safety risk for bottom-dwelling fish, compared to the costs of burying, covering or removing them. This means that pipes and cables can be left where there is no such fishing of any significance or where the pipes or cables have been or will be properly buried or covered up. According to DECC guidelines, pipes that are

adequately buried/entrenched are regarded as candidates for leaving *in situ*. This is subject to an assessment to establish that no exposed sections will develop and that the state of the pipe (adequately buried/entrenched) will persist /6/.

The likelihood of buried pipes and cables between Rev and Armada becoming exposed over time is considered low, as the seabed sediment in the area is made up of compact sand which is not exposed to significant erosion. Surveys of pipe/cable routes show that pipes and cables are securely buried /9/. To prevent snagging of fishing gear, any exposed sections of pipe will be buried and/or rock-dumped, or possibly cut off and taken ashore for final disposal. When the work is finished, an inspection will be conducted to ensure that any pipes left *in situ* are not considered to constitute a hindrance to fishing in the future.

However, gravel-dumped pipes and cables may be exposed over time if trawling activity, for example, gradually removes the gravel-dumping over the years. Any concrete mattresses may also impede trawling over time as the concrete elements project and break up in places. For this reason, removing gravel-dumped pipes (3) will be a positive step as it will reduce any risk of potential future exposure of gravel-dumped pipes/cables.

Estimated energy consumption and emissions into the air will be relatively similar for options 1 and 3; see section 8.1. The removal of gravel-dumped pipes and cables (3) is a technically complex and challenging operation, as it entails a lot of dredging and removal of rocks. For this reason, option 3 will entail more disturbance to the seabed than option 1. The removal option (3) will also pose a greater risk to personnel from handling pipes on deck. Leaving all pipes and cables in place (1) is considered less technically challenging and so constitutes less of a safety risk than removal (option 2). There will also be major costs associated with removing the pipes/cables compared to leaving them in place.

If preventive measures are implemented (see section 9) leaving the entire pipe system *in situ* (option 1) emerges as the most advantageous option overall.

9 Proposed preventive measures

The work on this study has not identified any significant issues that could have a negative environmental impact. However, possible preventive measures have been identified that could reduce the risk of events that might affect the environment, health and other economic activity in a harmful and/or negative way. The preventive measures have been identified as preparatory measures before and during the removal operation, and as follow-up activities after the removal operation is finished.

Prior activities:

- In general, good planning of the work will be exercised as this is an important condition for making the work safe, both for the personnel involved and to reduce emissions and risk of damage to the environment. It is also important to make use of experience from similar operations.
- A comparative analysis has been performed for the entire pipe system, including the parts in the UK sector.
- Prior to the removal operations, existing seabed surveys will be consulted. New surveys will be considered if necessary. When removal work is finished a new seabed survey will be carried out.
- As part of the detailed planning of the removal work, there will be an assessment of the possible incidence of substances and materials that are harmful to health and the environment. This assessment will focus on identifying mercury, radioactive deposits etc., although these are expected to be very limited on Rev.
- To minimise any negative impact on the local environment, including fishing and aquaculture, it is planned to provide information to local players in good time before the start of the individual activities as well as maintaining an effective dialogue between the parties involved.

Implementation:

- Any holes left after removing the seabed installations will be filled in.
- To minimise the risk of snagging fishing equipment, pipe ends will be removed/gravel-dumped.
- Navigation warnings should be sent out through the Norwegian Coastal Administration with daily positions of vessels working on removal/covering or inspection of the pipe system.
- Depending on the place and time of the operation, preventive measures will be implemented to minimise the impact of activities at the reception facility. Here, preventive measures could include close dialogue with the local population on the extent and duration of the work close to and on land.

Follow-up activities:

- After the removal activities, the seabed will be tidied up to eliminate the risk of damage to fishing gear and to reduce potential littering. When the removal is finished, verification and documentation work will be performed and reported to the authorities. The verification will comply with the applicable rules.

- The routes of pipes left *in situ* will be inspected over time to check that they are still buried in the seabed. If any exposed sections are found they will be covered with gravel/rocks. The details of these activities can be decided in consultation with the relevant authorities.

- According to the Activity Regulation and associated guidelines (Norwegian Environment Agency), two environmental monitoring studies will be carried out three years apart after the production phase on Rev has ended. The need for further environmental monitoring of the Rev field after that time will be assessed by the Norwegian Environment Agency. For the pipeline in the UK sector, DECC will be consulted with regard to any necessary verification inspections (including the “close-out report” and “post-decommissioning” monitoring and assessment) of pipes left *in situ*.

10 Summary of consultation responses to the impact assessment

The present impact assessment for the decommissioning of the Rev installations was sent for consultation to 35 bodies, with a deadline for responses of 12 weeks from 09.12.2014. The responses to consultation received are summarised in Table 23.

Table 23. Summary of consultation responses to the impact assessment, with operator's reply

Body consulted and statements made	Talisman's assessment
1. Norwegian Directorate of Fisheries (Ref: 14/17072)	
Section 8.6 (recommended decommissioning solution) states that it is planned to completely remove the seabed installations associated with the Rev field. The Norwegian Directorate of Fisheries welcomes this. 1. It is also stated that, for the pipelines connected to the Rev field, various options have been evaluated. For options 1 and 3, on the other hand, buried pipes and cables between the Rev field and the Armada field will be left *in situ*. The Norwegian Directorate of Fisheries is generally sceptical of the current practice whereby pipes are left in place after the fields are decommissioned. It takes a very long time for pipes left *in situ* to decay naturally. Over time, two pipes left in place could be a hindrance to fishing with bottom-fishing gear, and could also pose a risk to the safety of the vessel, even if the pipes were originally buried or made over-trawlable in some other way. We ask that possible removal of pipes etc. be examined after the closure of the Rev field.	1. Talisman notes the comments, but believes that leaving pipes and cables in place is less technically challenging and so constitutes less of a safety risk than removal. The total emissions into the air and the marine environment will also be lower if the fixtures are left *in situ*. Talisman will therefore follow established practice in the industry and leave buried pipes *in situ*. Exposed sections and pipes which are not buried will be removed. Talisman does not plan to examine this further.
2. Norwegian Coastal Administration (Ref; 2014/824-3)	
1. The Rev field is located in Block 15/12, roughly 6 km south of the Varg field, close to the border with the UK continental shelf. 2. The Norwegian Coastal Administration assumes that TENAS will establish sufficient contingency during the removal operation to minimise the risk of traces of oil products or other chemicals leaking out.	1. In planning the activities on Rev, TENAS is taking account of its closeness to the UK continental shelf 2. The removal operations are being planned to keep the risk of any accidental discharges to a minimum. The contingency plans for the field will be evaluated to ensure that the contingency is sufficiently robust during the removal operations.
3. Norwegian Environment Agency (Ref: 2013/7390)	
In the opinion of the Norwegian Environment Agency, the most important foreseeable environmental effects of the various options have been explained in a satisfactory manner. There also appear to have been end-to-end	

assessments of the most relevant environmental aspects. The Norwegian Environment Agency has the following comments on the impact assessment:	
1. A reception facility on land must be selected that has the necessary permits to perform the tasks described in the impact assessment. The impact assessment also identifies facilities abroad and we would point out that an export application will then have to be sent to the sender authority.	1. Talisman confirms that the facilities that are to handle the cutting up on shore will have the necessary approvals and discharge permits from the authorities. If a foreign facility is chosen, an export application will be submitted.
2. Section 2.7 contains an overview of the necessary applications and permits for decommissioning Rev. The Norwegian Environment Agency asks that applications be submitted in good time before the activities that require these permits are started.	2. Applications for permits under the Pollution Act will be set in good time.
3. It is stated e.g. in section 2.2.1.2 that marine growth will accompany the installations ashore and will be removed from the structures at the reception facility. Experience shows that this removal takes a lot of time and could cause significant odour problems in the area around the facility. Provided that the growth is not contaminated with environmental toxins from e.g. growth-inhibiting agents, the Norwegian Environment Agency prefers the option of removing the growth before the installations are brought ashore; cf. Recommendations made in the report *Decommissioning of disused offshore installations (TA 2643/2010, May 2010*). We therefore ask you to examine further whether the removal of marine growth offshore could be a viable solution for Rev.	3. Consideration will be given to removing marine growth offshore before removal, otherwise it will be brought ashore.
4. If there are to be operations with a risk of discharges of oil, the project should try to avoid periods in the winter time when there are expected to be large numbers of guillemots in the area.	4. The installations will be emptied of oil, cleaned and secured before removal to minimise the risk of discharges. The removal operations will have weather restrictions, making it advisable to implement the project in the summer.
4. Norwegian Fishermen's Association (Ref: 2014/00094-5)	
1. The Norwegian Fishermen's Association welcomes the fact that most equipment will be removed when production on the Rev field ends. It is recommended that documentation should be produced (ideally using video) to show the state of the field after the installation has been removed.	1. Talisman confirms that there will be an inspection after removal to document that the area has been cleared as specified.
2. With regard to the pipes, the Norwegian Fishermen's Association disagrees with the established practice of	2. Talisman notes the comments, but believes that leaving pipes and cables in place is less technically

leaving all or part of them *in situ*. It is clear that there are environmental concerns and other uses of the sea that should determine future disposal. That also means that socio-economic factors should be considered. But this decommissioning process has not included a sufficiently good socio-economic assessment of the costs, based on possible future fishing activity arising from the changes we are seeing in fish stocks (species and availability). The Norwegian Fishermen's Association also notes that there is a tendency for individual sections to become exposed, and Talisman believes this is best addressed by cutting up and rock-dumping these cutting areas. The Norwegian Fishermen's Association does not agree that this solves a future problem, and believes it is better to remove the pipes. The more areas have to be rock-dumped, the more areas could pose a risk of damage to fishing gear. The calculations of sustainability (lifetime) have been made under certain assumptions. When the date of a possible "collapse" in a pipe approaches, large parts of the continental shelf may become unusable by bottom-dragged gear. For this reason, active efforts should be made to find a technology that can easily remove pipes too.	challenging and so constitutes less of a safety risk than removal. The total emissions into the air and the marine environment will also be lower if the fixtures are left *in situ*. Talisman will therefore follow established practice in the industry and leave buried pipes *in situ*. Exposed sections and pipes which are not buried will be removed.
5. Directorate for Cultural Heritage (Ref: 14/00417-7)	
The Directorate for Cultural Heritage is satisfied with the impact assessment for winding up operations and disposing of the installations from the Rev field. The Directorate for Cultural Heritage's comments on the analysis programme have been noted and followed up in a positive way. 1. We expect this to be followed with good cooperation with the Norwegian Petroleum Museum and Stavanger Maritime Museum in the practical work to wind up the operation and dispose of the installations and to produce documentation.	1. Talisman will follow up cooperation with the Norwegian Petroleum Museum and Stavanger Maritime Museum and clarify whether documentation needs to be produced in connection with winding up operations in the Varg field.
6. Norwegian Radiation Protection Authority (Ref. 14/00177/425.1)	
1. Talisman Energy Norge AS has incorporated most of the Norwegian Radiation Protection Authority's comments on the draft impact assessment into the present impact assessment, but has not added the Norwegian Radiation Protection Authority to the list of necessary applications and permits. The Norwegian Radiation Protection Authority has no further comments.	1. Talisman confirms that detailed planning will focus on identifying radioactive deposits and that any emissions will be applied for.

No comment.	
7. Ministry of Labour and Social Affairs (Arbeids- and sosialdepartementet)	**8. Industrial and Energy Workers' Union (Fagforbundet Industri Energi)**
9. Norwegian Institute of Marine Research (Havforskningsinstituttet)	**10. Norwegian Ministry of Climate and Environment**
11. Norwegian Petroleum Directorate (Oljedirektoratet)	
No comments made.	
12. Directorate of the Norwegian Labour Inspection Authority (Arbeidstilsynet)	**13. Ministry of Defence (Forsvarsdepartementet)**
14. County Governor of Hordaland	**15. County Governor of Rogaland**
16. County Governor of in Vest Agder	**17. Greenpeace Norway**
18. Board of Health Supervision in Rogaland	**19. Ministry of Local Government and Modernisation (Kommunal- og moderniseringsdepartementet)**
20. Trade Union Federation Rogaland (LO Rogaland)	**21. Bellona Foundation (Miljøstiftelsen Bellona)**
22. "Nature and Youth" (Natur og Ungdom)	**23. Green Warriors of Norway (Norges Miljøvernforbund)**
24. Friends of the Earth Norway (Norges Naturvernforbund)	**25. Norwegian Institute for Urban and Regional Research (Norsk institutt for by- and regionforskning)**
26. Norwegian Petroleum Museum (Norsk Oljemuseum)	**27. Norwegian Oil and Gas Association (Norsk Olje og Gass)**
28. Norwegian Ornithological society (Norsk Ornitologisk Forening)	**29. Norwegian Polar Institute (Norsk Polarinstitutt)**
30. Ministry of Trade, Industry and Fisheries (Nærings- og fiskeridepartementet)	**31. Ministry of Petroleum and Energy (Olje og energidepartementet)**
32. Petroleum Safety Authority Norway (Petroleumstilsynet)	**33. Rogaland county administration**
34. Trawlermen's association of southern Norway (Sør-Norges Trålarlag)	**35. WWF Norway**

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Appendix – Responses to consultation

1. Norwegian Directorate of Fisheries (Fiskeridirektoratet)
2. Norwegian Coastal Administration (Kystverket)
3. Norwegian Environment Agency (Miljødirektoratet)
4. Norwegian Fishermen's Association (Norges Fiskarlag)
5. Directorate for Cultural Heritage (Riksantikvaren)
6. Norwegian Radiation Protection Authority (Statens Strålevern)
7. Ministry of Labour and Social Affairs (Arbeids- and sosialdepartementet)
8. Industrial and Energy Workers' Union (Fagforbundet Industri Energi)
9. Norwegian Institute of Marine Research (Havforskningsinstituttet)
10. Ministry of Climate and Environment (Klima- og miljødepartementet)
11. Norwegian Petroleum Directorate (Oljedirektoratet)

FISKERIDIREKTORATET

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Contact: Lise Langård
Tel.:
Section: Development section
Our reference: 14/17072
Your reference:
Our date: 03.02.2015
Your date:

Att:

DECOMMISSIONING AND DISPOSAL OF INSTALLATIONS ON THE REV FIELD – CONSULTATION ON THE IMPACT ASSESSMENT

We refer to your letter of 9 December 2014 concerning the above impact assessment.

The Rev field is located in Block 15/12 in the central part of the North Sea, roughly 6 km south of the Varg field, close to the border with the UK continental shelf. The Rev field is classed as a gas condensate field and consists of an oil zone topped with a gas cap. Rev has a nominal depth of water of 85 m.

The field is a seabed facility comprising four seabed installations split into two separate areas, Rev West and Rev East. The original Rev project included two production wells; the third was introduced only later. The first two producers are situated in Rev West, while the third is in Rev East. A gas export PLEM (pipeline end manifold) is now (2014) also connected to the Rev field. Rev East is connected to the gas export PLEM.

Comments from the Norwegian Directorate of Fisheries

Section 8.6 (recommended decommissioning solution) states that
it is planned to completely remove the seabed installations on the Rev field. The Norwegian Directorate of Fisheries welcomes this.

It is also stated that, for the pipelines connected to the Rev field, various options have been evaluated. For options 1 and 3, on the other hand, buried pipes and cables between the Rev field and the Armada field will be left *in situ*. The Norwegian Directorate of Fisheries is generally sceptical of the current practice whereby pipes are left in place after the fields are decommissioned. It takes a very long time for pipes left

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in situ to decay naturally. Over time, pipes left *in situ* could be a hindrance to fishing with bottom-fishing gear, and could also pose a risk to the safety of the vessel, even if the pipes were originally buried or made over-trawlable in some other way. We ask that possible removal of pipes etc. be examined after the closure of the Rev field.

The Directorate of Fisheries has no other comments on the analysis programme for the impact assessment for the Rev field. We assume that any comments concerning biological resources will come from the Norwegian Institute of Marine Research.

Best
regards,

Anne Kjos Veim
Head of Section

Lise Langård,
Adviser

Distribution:

Talisman Energy Norge AS	Veven 4	4003	STAVANGER

Cc:

Norwegian Institute of Marine Research	Postboks 1870 Nordnes	5817	BERGEN
Norwegian Fishermen's Association	Postboks 1233 Sluppen	7462	TRONDHEIM
Ministry of Trade, Industry and Fisheries	Postboks 8090 Dep.	0032	OSLO
Ministry of Petroleum and Energy	Postboks 8148 Dep.	0033	OSLO

KYSTVERKET

Encl.

Talisman Energy Norge AS
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Oslo, 18.02.2015

Your ref.:
REV01-24981-Z-RA-0001

Our ref. (please quote in all correspondence):
2013/7390

Contact:
Solveig Aga Solberg

Comments on the impact assessment for decommissioning and disposal of installations on Rev – Talisman Energy Norge AS

The most important environmental aspects of the decommissioning and disposal of installations on the Varg field appear to be adequately covered in the impact assessment.

Applications for permits under the Pollution Act must be sent to the Norwegian Environment Agency in good time before any activities requiring a permit start.

We refer to the letter from Talisman Energy Norge AS (TENAS) dated 9 December 2014 forwarding the impact assessment for decommissioning and disposal of installations on Rev.

1. Background – impact assessment

The Rev field is located in Block 15/12 in the central part of the North Sea close to the border with the UK continental shelf. The field is classed as a gas condensate field. The depth of water in the area varies mainly between 90-110 metres and the sediments are mainly composed of dense fine sand. Rev comprises four seabed installations split into two separate areas, Rev West and Rev East. From the Rev field, a nine-kilometre pipeline is routed to the Armada installation on the UK continental shelf, where all processing takes place. Since Q1 2014 gas has been transported from the Varg field via the Rev infrastructure and on to the UK.

The Rev field started production in 2009 and now comprises three gas production wells. Pressure in the reservoir is falling and it is expected that production from Rev will cease in the near future. Gas transport from the Varg field enables periodic production from Rev with the aid of a pressure build-up in the wells.

Drilling has been carried out on Rev with both water and oil-based drilling fluid. Discharges of oil-based drill cuttings were prohibited from 1991, so only cuttings drilled with water-based drilling fluid have been discharged. The estimated volume of water-based cuttings discharged in the period 2006-2012 is approx. 3,400 tonnes. Rev is located in Region II on the Norwegian continental shelf and forms part of the regional environmental inspection of the region carried out every three years. Results from environmental monitoring activities show that the sediments around Rev are slightly contaminated with hydrocarbons (THCs).

The Rev field is located within an area where guillemots are present on the open sea in the winter time. There will be an environmental value of 6-7 in the period from December to March inclusive.

Various disposal options for Rev have been evaluated. If no solutions for re-use can be found, TENAS plans to remove the seabed installations with a lifting vessel and take them ashore for cutting up, disposal and recycling of materials according to the regulations. The actual removal operation is considered to have "insignificant/no" impact. This is because the impact will be geographically limited and of brief duration, and any discharges and effects on the water column/seabed will be limited in terms of volume.

For the pipe system, the recommended solution from TENAS is to leave it *in situ*. The operator justifies its desire to leave the pipes *in situ* on the basis that there will be heavy costs associated with removing the pipe system, as well as a greater safety risk. The total emissions into the air and the marine environment will also be lower if the fixtures are left *in situ*. To prevent snagging of fishing gear, any exposed sections of pipe will be rock-dumped, or possibly cut off and taken ashore for final disposal.

For further information, refer to the operator's impact assessment.

2. Assessment by the Norwegian Environment Agency

In the opinion of the Norwegian Environment Agency, the most important foreseeable environmental effects of the various options have been explained in a satisfactory manner. There also appear to have been end-to-end assessments of the most relevant environmental aspects. The Norwegian Environment Agency has the following comments on the impact assessment:

- A reception facility on land must be selected that has the necessary permits to perform the tasks described in the impact assessment. The impact assessment also identifies facilities abroad, and we would point out that an export application will then have to be sent to the sender authority.

- Section 2.7 contains an overview of the necessary applications and permits for decommissioning Rev. The Norwegian Environment Agency asks that applications be submitted in good time before the activities that require these permits are started.

- It is stated e.g. in section 2.2.1.2 that marine growth will accompany the installations ashore and will be removed from the structures at the reception facility. Experience shows that this removal takes a lot of time and could cause significant odour problems in the area around the facility. Provided that the growth is not contaminated with environmental toxins from e.g. growth-inhibiting agents, the Norwegian Environment Agency prefers the option of removing the growth before the installations are brought ashore; cf. Recommendations made in the report *Decommissioning of disused offshore installations (TA 2643/2010, May 2010*). We therefore ask you to examine further whether the removal of marine growth offshore might be a viable solution for Rev.

- If there are to be operations with a risk of discharges of oil, the project should try to avoid the periods in the winter time when there are expected to be large numbers of guillemots in the area.

Best regards,
Norwegian Environment Agency

This document has been approved electronically so does not carry any signature

Hanne Marie Øren	Solveig Aga Solberg
Head of Section	Senior Engineer

Cc:

Ministry of Climate and Environment	Postboks 8013 Dep. 0030 OSLO
Ministry of Petroleum and Energy	Postboks 8148 Dep. 0033 OSLO

Talisman Energy Norge AS

NORWEGIAN
FISHERMEN'S
ASSOCIATION
FISKARLAGETS SERVICEKONTOR AS

Our date	Our ref.	Our *contact*	*Your reference*
13.01.2015	2014/00094-5	Elling Lorentsen/93096583	TEN-OED-2014·0033

Decommissioning and disposal of installations on the Rev field – response to consultation on the impact assessment.

The Norwegian Fishermen's Association refers to the impact assessment for decommissioning and disposal of installations on the Rev field forwarded by letter dated 9 December 2014 This gives the following description of the location of and activity on the Rev field, with suggestions for disposal after decommissioning.

The Rev field is located roughly 6 km south of the Varg field, close to the border with the UK sector. The field is a seabed facility comprising four seabed installations split into two separate areas, Rev West and Rev East.

Production on the Rev field started in 2009. Drilling has been carried out with both water and oil-based drilling fluid, but only water-based cuttings have been discharged into the sea, as discharges of oil-based cuttings were prohibited from 1991. The estimated volume of water-based cuttings discharged in the period 2006-2012 is approx. 3,400 tonnes.

It is stated that various disposal solutions have been evaluated for Rev, and the recommended option for the seabed installations is complete removal. For the pipe system connected to the Rev field, Talisman Energy Norge AS recommends leaving the entire system *in situ*.

Refer to Storting white paper no 47 (1999–2000), which says that, as a general rule, permission should be given for pipes and cables to be left in place where they do not cause inconvenience or constitute a safety risk for bottom-dwelling fish, compared to the costs of burying, covering or removing them. This means that pipes and cables can be left where there is no such fishing of any significance.

According to Storting white paper no 47, the disposal of pipelines and cables may include further use in the petroleum industry, other use, complete or partial removal or leaving them *in situ*. Any assessment of the disposal options should be based on environmental considerations and other uses of the sea, taking account of costs and socio-economic factors. It must also consider the safety risk to the person who is to do the job of removing the pipes.

This removal option involves removing the buried production pipeline (9.1 km), the entrenched control cable (9.8 km) and gravel-dumped control cables and jumpers. The last inspection confirmed that the pipes and cables are securely buried, with only a few sections of control cable displaying a tendency towards exposure. To prevent snagging of fishing nets, any exposed or suspended sections of pipe will be buried and/or rock-dumped, or possibly cut off and taken ashore for final disposal. The pipe end

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pieces will either be buried and covered over or removed together with the base frame.

The Norwegian Fishermen's Association welcomes the fact that most equipment will be removed when production on the Rev field ends. It is recommended that documentation should be produced (ideally using video) to show the state of the field after the installation has been removed.

With regard to the pipes, the Norwegian Fishermen's Association disagrees with the established practice of leaving all or part of them *in situ*.

It is clear that there are environmental concerns and other uses of the sea that should determine future disposal. That means that socio-economic factors should also be considered. But this decommissioning process has not included a sufficiently good socio-economic assessment of the costs, based on possible expected fishing activity arising from the changes we are seeing in fish stocks (species and availability).

The Norwegian Fishermen's Association also notes that there is a tendency for individual sections to become exposed, and Talisman believes this is best addressed by cutting up and rock-dumping these cut areas. The Norwegian Fishermen's Association does not agree that this solves a future problem, and believes it is better to remove the pipes. The more areas have to be rock-dumped, the more areas could pose a risk of damage to fishing gear. The calculations of sustainability (lifetime) have been made under certain assumptions. When the date of a possible "collapse" in a pipe approaches, large parts of the continental shelf may become unusable by bottom-dragged gear. For this reason, active efforts should be made to find a technology that can easily remove pipes too.

Best regards,
NORWEGIAN FISHERMEN'S ASSOCIATION

Jan Skjærvø

[Signature]
Elling Lorentsen

Cc: Ministry of Petroleum and Energy
Ministry of Trade, Industry and Fisheries
Directorate of Fisheries
Member associations

Encl.

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14/00417-7

YOUR REF.:
2014-0033

FILE Admin file
865.2

YOUR DATE

OUR DATE:
29.01.2015

Talisman Energy Norge AS
Postboks 649 Sentrum
4003 STAVANGER

Rev – Impact assessment for decommissioning and disposal of installations. Request for approval. Comments from the Directorate for Cultural Heritage

The Directorate for Cultural Heritage refers to the letter from Talisman Energy Norge AS dated 10.12.2014 on the above matter.

The Directorate is satisfied with the impact assessment for decommissioning and

Statens strålevern
Norwegian Radiation Protection Authority

Talisman Energy Norge AS

Postboks 649 Sentrum

4003 STAVANGER

Your ref.	Our ref.	Our date
	14/00177/425.1	25.02.2015
	Contact: Vibeke Brudevold	

Comments on the request for approval of the impact assessment for decommissioning and disposal of installations on Rev

Talisman Energy Norge AS has incorporated most of the Norwegian Radiation Protection Authority's comments on the proposed analysis programme into the present impact assessment, but has not added the Authority to the list of necessary applications and permits. The Authority has no further comments.

The Norwegian Radiation Protection Authority (Strålevernet) refers to the letter from Talisman Energy Norge AS (Talisman), dated 9 December 2014, concerning consultation on its request for approval of the impact assessment for decommissioning and disposal of installations on the Rev field.

Rev is an oil field located in the area of production licence 038C, Block 15/12 in the central part of the North Sea, close to border with the UK continental shelf. The Rev field is connected to the UK's Armada platform, where the well stream is processed. The field was discovered by Norsk Hydro in 2001, but since the takeover in 2005 it has been developed and operated by Talisman. The Rev field is equipped with a seabed facility comprising three seabed installations. The well stream from the field passes through a 9.1 km pipeline to the Armada field in the UK sector, where it is then processed. It is expected that production on Rev will end no earlier than mid-2015.

In our comments on the analysis programme for the impact assessment, the Norwegian Radiation Protection Authority pointed out that the existing permit for emissions of radioactive substances from the Rev field applies to the operational phase, and that any emissions arising from cleaning work on the installation after production has ceased will require a separate permit. Talisman makes no mention of the possible need for a permit from the Norwegian Radiation Protection Authority in section 2.7 of the impact assessment, which deals with applications and permits. We are therefore mentioning it in these comments also.

It is clear from the impact assessment that Talisman will focus on identifying radioactive deposits during the detailed planning of the removal work. The Norwegian Radiation Protection Authority considers that this addresses problems linked to radioactive waste and radioactive pollution.

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The Norwegian Radiation Protection Authority notes that our comments have been incorporated into the impact assessment, and has no further comments on this.

Best regards,

Kristin Elise Frog
Director

Solveig Dysvik
Head of Section

Cc: *Ministry of Climate and Environment, Postboks 8013 Dep. 0030 Oslo*
Ministry of Petroleum and Energy, Postboks 8148 Dep. 0033 OSLO

MINISTRY OF LABOUR AND SOCIAL AFFAIRS

Talisman Energy Norge AS
Postboks 649 Sentrum
4003 STAVANGER

Your ref.	Our ref.	Date
TEN-OED-2014-0033	14/761-	10 FEB 2015

Approval of the impact assessment for decommissioning and disposal of installations on Rev – input from ASD

The Ministry of Labour and Social Affairs refers to the letter of 9 December 2014 concerning the request for approval of the impact assessment for decommissioning and disposal of installations on Rev.

The Ministry has referred the matter to the Petroleum Safety Authority Norway. The Ministry has no comments.

Best regards,

Torkel Sandegren (p.p.)
Head of Department

Helga Sjølli Grimstad
Adviser

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From:	Bente.Havre@industrienergi.no on behalf of horinger@industrienergi.no
To:	Norway, Correspondence Contact
Cc:	postmottak@oed.dep.no
Subject:	CONS-TEN-2014-0003 / TEN-OED-2014-0033 Request for approval of the impact assessment for decommissioning and disposal of installations on Rev
Date:	15 December 2014 12:12:49

Hello,
We refer to the above consultation, ref. TEN-OED-2014-0033

The Industrial and Energy Workers' Union has no comments on this matter.

Best regards,
Bente Havre
Secretary, Collective Bargaining Section.

HAVFORSKNINGSINSTITUTTET
INSTITUTE OF MARINE RESEARCH

Talisman Energy

Att: Hovden, Monica

Your ref.:

Our ref.: 2014/236
File-ref. 321
Serial-no: 3429/2015

Bergen 27.02.2015

REQUEST FOR APPROVAL OF THE IMPACT ASSESSMENT FOR DECOMMISSIONING AND DISPOSAL OF INSTALLATIONS ON REV

The Norwegian Institute of Marine Research has reviewed the impact assessment for decommissioning and disposal of installations on Rev. The Institute notes that it is not planned to discharge water in connection with the removal of the seabed installations, and that any discharges from the cleaning operations or other activities that could cause pollution of the external environment will be subject to an discharge permit from the Norwegian Environment Agency, and are not covered by the present impact assessment. Otherwise, we find the content and quality of the impact assessment satisfactory. We therefore have no comments on the matter.

Best regards,

Stepan Boitsov
Researcher

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DET KONGELIGE
KLIMA- OG MILJØDEPARTEMENT

Talisman Energy Norge AS
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4003 STAVANGER

Your ref.	Our ref.	Date
TEN-OED-2014-0033	14/565	02.03.2015

Response to consultation – Request for approval of the impact assessment for decommissioning and disposal of installations on Rev

We refer to the letter from Talisman Energy Norge AS dated 9 December 2014 concerning its request for approval of the impact assessment for decommissioning and disposal of installations on Rev.

The Ministry of Climate and Environment refers to the responses from the Norwegian Environment Agency, the Directorate for Cultural Heritage and the Norwegian Radiation Protection Authority. We have no other comments on the application.

Best regards,

Per Schive (p.p.)
Head of Department

Hege Jordbakke
Principal Consultant

This document has been approved electronically, and so bears no handwritten signature.

Cc:

Ministry of Petroleum and Energy Postboks 8148 Dep. 0033 OSLO

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From:	Nag, Lars Asbjørn
To:	Norway, Correspondence Contact
Cc:	"postmottak@oed.dep.no"; Norwegian Petroleum Directorate
Subject:	Impact assessment for decommissioning and disposal of installations on Rev
Date:	27 February 2015 07:59:53
Attachments:	image001.gif

The Norwegian Petroleum Directorate refers to the letter of 9 December 2014 from Talisman Energy Norge AS concerning the impact assessment for decommissioning and disposal of installations on Rev. The Directorate has no comments on the impact assessment.

Best regards,

Lars Asbjørn Nag
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