

## Section 9

# Cumulative and transboundary impacts from implementing the Draft Plan

## 9 Cumulative and transboundary impacts from implementing the Draft Plan

### 9.1 Introduction

Cumulative impacts occur as a result of a number of activities, discharges and emissions combining or overlapping, potentially creating a significant impact. Potential cumulative impacts could arise as a result of impacts resulting from seismic and exploration activities interacting or combining with those from other activities taking place in the IOSEA1 area. These may include, for example, pre-existing licensed seismic survey and exploratory drilling, marine scientific research, commercial fishing, shipping and military activities. Some of the impacts assessed in Sections 7 and 8 also have the potential to combine with each other, and should therefore be considered together or cumulatively in this section.

### 9.2 Noise

#### 9.2.1 Cumulative impacts from seismic surveys

Table 9.1 shows the predicted new and pre-existing seismic survey effort in the IOSEA1 area, for the period 2006 to 2011, expressed as days at sea. The table shows that, within the IOSEA1 area, the highest levels of seismic survey activity are expected in 2007, when a maximum total of 194 days are predicted to take place. The practical operational timing of seismic survey is weather dependent and, therefore, can effectively only take place during the summer months when the weather is most likely to be suitable. As a consequence seismic surveys may overlap, particularly during the years where the predicted survey effort is greater than 3 months per year.

**Table 9.1 Maximum estimated survey effort in the IOSEA1 area for the period 2006 to 2010**

Survey method	Maximum estimated annual survey effort in days at sea					
	2006	2007	2008	2009	2010	2011
Pre-existing 2D	60	80	0	0	0	0
Pre-existing 3D	57	54	0	0	0	0
New 2D	40	60	0	0	0	0
New 3D	0	0	36	107	107	0
<b>Total seismic survey effort</b>	<b>157</b>	<b>194</b>	<b>36</b>	<b>107</b>	<b>107</b>	<b>0</b>

When compared with a single survey or consecutive surveys, simultaneous seismic surveys will increase the area affected by anthropogenic noise. If either the noise source (ie the seismic survey vessel) or animals move, an individual animal could encounter a potentially harmful sound source on more than one occasion. If multiple (seismic) vessels generate sound simultaneously, the sounds received by the animal become less directional. In addition, the dispersion of noise in such a complex bathymetric environment will reduce the effectiveness of a marine mammal's directional hearing, and therefore their ability to discriminate sounds of interest from background noise. The short-term effect to whales subject to multiple seismic surveys may be to move away from the sound source. Longer-term exposure, however, may cause habituation to such noises (Richardson *et al*, 1995).

Large numbers of marine mammals are present in the waters west of Ireland, as a result of upwelling currents bringing plentiful supplies of food. In addition, there is some evidence that the area is used as a migratory pathway by certain baleen whale species. Gordon *et al* (1998) suggests that migratory pathways could be interrupted and feeding grounds disrupted if several seismic surveys occur at the same time. However, studies both in northwestern Australia and along the Californian coast have indicated that baleen whales continue to migrate into areas of consistently high survey activity, and along coastlines subjected to decades of seismic activity (McCauley, 1994).

In the event that there is a requirement for multiple surveys, in the same area and at the same time, it is advised these are combined into consecutive surveys through appropriate planning and co-operation. If surveys must be carried out simultaneously, a separation distance of 100 km should be observed between survey vessels, so that marine mammals and fish have the chance to avoid these areas and migration routes are not impeded.

### 9.2.2 Cumulative impacts from drilling operations

Table 9.2 shows the predicted new and pre-existing maximum drilling activity in the IOSEA1 area for the period 2006 to 2011, expressed in drilling time (assuming an average drilling time of 50 days per well).

**Table 9.2 Maximum estimated drilling time in the IOSEA1 area for the period 2006 to 2011**

Drilling method	Maximum estimated drilling time (days)					
	2006	2007	2008	2009	2010	2011
Pre-existing exploration drilling	50	150	150	50	50	50
Pre-existing appraisal drilling	0	50	50	100	100	100
Pre-existing production drilling	200	200	150	100	50	50
New exploration drilling	0	0	100	100	100	100
New appraisal drilling	0	0	0	100	100	100
New production drilling	0	0	0	50	100	100
<b>Total drilling</b>	<b>250</b>	<b>400</b>	<b>450</b>	<b>500</b>	<b>500</b>	<b>500</b>

The table shows that drilling activity will increase over the years, levelling out at 500 days per year. This indicates that, from 2007 onwards, multiple drilling operations will have to take place simultaneously, in order to accommodate the maximum level of drilling activity.

The sound levels and frequencies generated by a semi-submersible drilling rig are in many ways comparable with those generated by a large merchant vessel. Sound transmission calculations estimate that a small proportion of any baleen whale in the area may respond to the drilling noise by avoiding the drill site up to a radius of 1 km. At certain times, multiple drilling operations are expected to take place simultaneously within the IOSEA1 area. It is unlikely that the underwater sound generated by these operations will overlap in such a way as to cause a significant cumulative impact.

### 9.2.3 Cumulative impacts of seismic and drilling activities

It is likely that, at certain times, seismic survey and drilling operations will take place simultaneously within the IOSEA1 area. Baleen whales, beaked whales and seals are thought to be the most sensitive marine mammals to the low frequency sound and are predicted to show avoidance reactions from 2 to 20 km from a seismic sound source and within 1 km of a drilling source. Fish avoidance reactions to seismic survey might be expected within 11.5 km of the source, though evidence of fish avoidance at greater distances has been reported.

Both seismic survey and drilling activity are temporary and of short duration. It is unlikely, therefore, that there will be any significant cumulative impacts resulting from the interaction of these two sound sources. However, it must be stressed that the long-term implications of such noise sources, or their cumulative and synergistic interactions, are unknown.

### 9.2.4 Cumulative impact of seismic and drilling activities with other users of the sea

Other users of the IOSEA1 area may include merchant shipping, fishing, marine scientific research, and naval vessels. Table 7.2 in Section 7 shows some indicative sound levels of various users of the sea. This table shows that, in general, sound levels of all these users are attenuated to below levels expected to cause any effects on marine mammal or fish behaviour within 1 km from the source (with the exception of seismic surveys).

With a 500 m exclusion zone in place around each drilling rig, the interaction of underwater drilling noise with those noises generated by other users of the sea is unlikely to cause a significant cumulative effect, due to the transitory and temporary nature of the various other activities. In addition, any other vessel in the vicinity, with the exception of those vessels servicing the rig itself, will be passing, and any cumulative effect will be of short duration.

Due to the high sound levels generated by seismic surveys, underwater sounds are more likely to interact with other users of the sea at some level. However, any interaction with passing vessels is expected to be of short duration, and no significant cumulative impacts are expected to arise as a result of such encounters.

### 9.2.5 Transboundary impacts

Any transboundary impacts with regard to noise during seismic surveys and drilling activity will be limited in scale and of very short duration. However, in view of the likelihood that seismic surveys can interfere with each other and can give rise to environmental impacts, notification of seismic activity planned within 100 km of the Ireland/UK boundary will be given to the appropriate licensing authorities.

### 9.2.6 Conclusion

The long term, synergistic and cumulative impacts of sound sources in water are poorly understood. As a result, the introduction of additional low frequency noise into the marine environment from seismic surveys in the IOSEA1 area should be considered to have the potential to create a cumulative effect. However, the relatively short duration of the activities and relatively small radius of predicted effect suggests that seismic surveys and drilling operations are expected to have a limited temporal and spatial impact on the marine mammal and fish populations when appropriate mitigation measures are in place.

## 9.3 Discharge of drill cuttings and disturbance to sea bed

Drilling activity within the IOSEA1 area has been low historically, with some 16 wells drilled between 1978 and 2003 (PAD, 2006a), or between one and two wells per year on average. Pre-existing licensed drilling activity in the IOSEA1 area may result in up to 33 wells being drilled between 2006 and 2011, which equates to between five and six wells per year. Implementation of the Draft Plan may lead to the drilling of a further 19 wells between 2008 and 2011, raising the total to 52 wells in the IOSEA1 area between 2006 and 2011, (see Section 4.2), and increasing the drilling rate to between nine and ten wells per year between 2008 and 2011.

As discussed in Section 8.3.2, the drilling of 19 wells could result in direct physical effects to an area of sea bed totalling less than 0.33 km<sup>2</sup>. When considering the pre-existing licensed drilling also, the drilling of up to 52 wells would increase the total area of sea bed affected to less than 1 km<sup>2</sup>.

The extent of sea bed disturbance impacts potentially arising from the oil and gas industry amount to a very small proportion of the 25,000 km<sup>2</sup> IOSEA1 area. In addition, the temporary nature of anchoring impacts, and the very localised extent and low toxicity of discharged drilling wastes on the sea bed, lead to good recovery potential in the dynamic benthic environment of the IOSEA1 area. However, the significance of any impact depends on the nature of the benthic environment at the sites concerned, and whether or not particularly sensitive or important habitats or species, sea bed features or notable archaeological interests (wrecks most likely) are present.

Other activities taking place within the IOSEA1 area which lead to physical disturbance of the sea bed include commercial fishing for demersal or benthic species, and telecommunications cable installation. There is currently no aggregate extraction or aquaculture taking place within the IOSEA1 area, and there is no dredging or spoil dumping within the area either.

With regard to submarine cable laying, there is currently one cable running through the IOSEA1 area (Section 5.4.6) and there are no plans for additional cables at present.

With regard to fishing, there are demersal or static gear fisheries for Dublin Bay prawn, cod, haddock, whiting, saithe, plaice, sole, anglerfish, various crabs, crayfish, shrimp and scallops on the continental shelf in the IOSEA1 area (Section 5 and Annex). There are no data on the areas of sea bed trawled or dredged in or around the IOSEA1 area. There is year-round fishing activity throughout the area indicated by fishing vessels sighting data (Irish Navy, 2006). It is likely that the area estimated to be affected by the Draft Plan and pre-existing drilling activity would be a relatively small proportion of that affected by fishing.

Exploration drilling activity will be taking place in an environment that has long been used for a variety of economic activities, some of which disturb the sea bed. As the potential impacts from drilling discharges and physical disturbance to the marine environment tend to be localised, of short duration and with generally good recovery potential, the risks of cumulative impacts are considered to be low for this level of exploration and appraisal activity.

## 9.4 Atmospheric emissions

### 9.4.1 Cumulative impacts of emissions from seismic survey

In considering cumulative impacts in the IOSEA1 area in the past, levels of seismic survey activity for the oil and gas industry have varied widely from year to year. Some 39,232 km of 2D data have been acquired between 1972 and 2002 (PAD, 2006b). This averages out at 1,308 km per year. The same data source indicates that 5,015 km<sup>2</sup> of 3D seismic data were obtained between 1997 and 2002 from within the IOSEA1 area, which equates to roughly 836 km<sup>2</sup> per year.

Under pre-existing licensing arrangements, 3,500 km of 2D survey are estimated for 2006 to 2007 (1,750 km per year), together with 3,100 km<sup>2</sup> of 3D survey over the same period (1,550 km<sup>2</sup> per year). When combined with the estimates of seismic survey activity for the Draft Plan, the total for 2D survey is 6,000 km (3,000 km per year) between 2006 and 2007, and the total for 3D survey is 10,100 km<sup>2</sup> (2,020 km<sup>2</sup> per year) between 2006 and 2010. Therefore, it is likely that the current licensing round will see emission rates from seismic survey more than double those previously experienced in the IOSEA1 area per year on average.

However, when translated into shipping activity, this approximates to 195 days of ship time per year (Section 4, Tables 4.3 and 4.4) or two or three additional vessels working in the offshore IOSEA1 area per year. When set against the context of general shipping activity (8,768 vessels per year, or 27 vessels at any one time within the IOSEA1 area; Anatec, 2006; Annex), and the steadily rising trend in ship numbers and tonnage using ports on the Irish west coast, the additional impacts of emissions resulting from seismic survey in the IOSEA1 area are likely to be negligible.

The emissions potentially resulting from seismic survey over one year from both the proposed Draft Plan and pre-existing licensed activity have been combined in Table 9.1, and the resultant GWP compared with the total GWP from Ireland in 2003. Emissions from total exploration activity amount to just over 0.03% of the Irish total.

On this basis, the incremental contribution of the draft plan to the cumulative impacts of emissions generated from Irish activities as a whole can be viewed as being negligible.

**Table 9.3 Total annual emissions due to seismic survey from the proposed Draft Plan and pre-existing licensed activity, set against a national context**

	Seismic emissions for 1 year (195 days @ 15 tonnes fuel/day)	Total emissions from Ireland (EPA, 2003)
Emissions (tonnes)		
CO <sub>2</sub>	9,360.00	
CO	24.28	
NO <sub>x</sub>	106.47	
N <sub>2</sub> O	0.64	
SO <sub>2</sub>	11.70	
CH <sub>4</sub>	0.32	
VOC	3.51	
<b>Global Warming Potential (tonnes CO<sub>2</sub> equivalent)</b>	<b>13,936.48</b>	<b>42,000,000</b>
<b>Acidification Potential (tonnes SO<sub>2</sub> equivalent)</b>	<b>270.93</b>	

Calculations according to UKOOA (1999).

### 9.4.2 Cumulative impacts of emissions from drilling activity

Within the IOSEA1 area, 16 wells have been drilled between 1978 and 2003 (PAD, 2006a), which averages out at 1.75 wells per year. Under pre-existing licensing arrangements, between 13 and 33 wells of all types may be drilled within the same area over the period 2006 to 2011 (2.1 to 5.5 wells per year). Over the same period, IOSEA1-related drilling activity (6 to 19 wells total) could range from 1 to 3.2 wells per year. The biggest impact in terms of overall emissions quantities will occur if the maximum likely activity levels from the Draft Plan are assumed, against the backdrop of maximum likely background or pre-existing drilling activity. The emissions resulting from this combination have been estimated in Table 9.2.

On a regional scale, the maximum emissions likely to result from implementation of the Draft Plan could increase the total emissions from drilling activity in the IOSEA1 area by 57%.

At a national scale, the annual emissions resulting from both pre-existing activity (75,225 tonnes) and the current licensing round or the Draft Plan (43,064 tonnes) remain small in comparison with Irish emissions as a whole. Against the figure of 42 million tonnes CO<sub>2</sub> equivalent for 2002, the annual emissions from pre-existing activity equate to 0.2% whilst those from IOSEA1 activity would be just 0.1%. The combined emissions from pre-existing activity and the Draft Plan (118,288 tonnes) would be less than 0.3% of total annual Irish emissions.

**Table 9.2 Comparison of emission estimates (tonnes) resulting from pre-existing licensed drilling activity with that resulting from the Draft Plan (maximum activity levels assumed)**

	Maximum background (pre-existing) activity - 33 wells and 16 well tests 2006 to 2011	Maximum IOSEA1-related activity - 19 well and 9 well tests 2006 to 2011	Total emissions 2006 to 2011	% increase over background	Maximum background (pre-existing) activity - per year	Maximum IOSEA1-related activity - per year
<b>Global Warming Potential (tonnes CO<sub>2</sub> equivalent)</b>	451,349.29	258,381.20	709,730.49	57%	75,224.88	43,063.53
<b>Acidification Potential (tonnes SO<sub>2</sub> equivalent)</b>	2,729.00	1,561.92	4,290.92	57%	454.83	260.32

Calculations according to UKOOA (1999).

#### 9.4.3 Cumulative impacts of combined emissions from seismic and drilling activity

The combined emissions on an annual basis from both seismic survey (13,936.48 tonnes) and drilling (118,288 tonnes) activities, including both pre-existing activity and the Draft Plan, amount to 132,225 tonnes CO<sub>2</sub> equivalent. This equates to 0.31% of the total annual Irish emissions for 2002 (EPA, 2003).

#### 9.4.4 Transboundary impacts drilling

With prevailing wind directions being from the west and southwest, most of the vessel emissions are likely to be deposited in Irish coastal waters or in Ireland. In terms of possible transboundary impacts, a small proportion of the emissions considered might end up in other European states including the UK, particularly those from the Donegal Basin area which is adjacent to the Ireland-UK national boundary. As outlined above in Section 9.4.8, the combined annual emissions anticipated from both seismic survey and drilling (including both pre-existing activity and the Draft Plan) amount to 132,225 tonnes CO<sub>2</sub> equivalent. This equates to 0.31% of the total annual Irish emissions of 42 million tonnes CO<sub>2</sub> equivalent for 2002 (EPA, 2003) and represents a minor incremental increase on the total likely transboundary impact.

Shipping emissions in the UK over the last ten years have fluctuated between approximately 1.5 to 2.0 million tonnes carbon dioxide equivalents (DEFRA, 2006). Set against this, and against the almost 200 million tonnes of carbon dioxide arising from European-flagged ships in 2000, the annual and total emissions estimated to result from the proposed seismic survey seem low by comparison. There is also a much higher level of exploration activity generally underway in the UK, and the impact of any emissions crossing over from exploration activity in the IOSEA1 area will be minor compared to these. For comparison, the total GWP of emissions from UK exploration activity in one year amounted to approximately 551,437 tonnes CO<sub>2</sub> equivalent (EEMS, 2004), although it should be noted that the UK Environmental Emissions Monitoring System (EEMS) only covers drilling rig fuel use and well testing, and excludes data on support vessels and helicopters. Within this framework the increases in atmospheric emissions resulting from the proposed seismic and drilling activity can only be viewed as negligible.

## 9.5 Physical presence

In terms of physical exclusion to other sea users, the combination of seismic survey and drilling activity is mutually exclusive; drilling at a location tends to follow on from a seismic survey. However, it may be useful to consider the total area affected by the proposed activities.

With regard to seismic survey, a 500 m exclusion zone applies around the vessel and streamers at any one time whilst on survey. Based on the information in Section 4, and taking the conservative (worst case) view that other sea users might realistically need to avoid not just the survey vessel itself but the whole survey area for the day, this could amount to an exclusion area amounting to 150 km<sup>2</sup> per day for a 2D survey and 90 km<sup>2</sup> per day for a 3D survey. Thus the Draft Plan for the IOSEA1 area would amount to 240 km<sup>2</sup> per day being excluded to other sea users for 70 days per year over the period 2006 to 2010. At the same time, pre-existing seismic activity could result in a 240 km<sup>2</sup> exclusion area per day for up to 125 days per year from 2006 to 2007. Thus for a two year period to 2007, the total area excluded to other vessels due to seismic survey could total 480 km<sup>2</sup> per day for most of the summer months. This is equivalent to less than 2% of the 25,000 km<sup>2</sup> offshore area covered by the Draft Plan.

In the case of drilling, up to 19 wells over 4 years (four to five per year) from the Draft Plan, and up to 33 wells over 6 years (up to six per year) from pre-existing licensing may be drilled, with an exclusion zone of 500 m radius around each. On this basis, the maximum level of drilling likely under the Draft Plan would cause a total exclusion area of less than 4 km<sup>2</sup>, pre-existing activity could cause a total exclusion area of 4.7 km<sup>2</sup>, and a total of up to 8.7 km<sup>2</sup> would be unavailable to other sea users in any one year on a temporary basis as a result of combining the two sets of drilling work. These totals are insignificant in relation to the 25,000 km<sup>2</sup> of offshore area being proposed for the Draft Plan, and are also much smaller than the exclusion that may possibly result from seismic survey activity. Together with the 'worst case' rough estimate for seismic survey of 480 km<sup>2</sup> per day, the total cumulative impact of implementing the Draft Plan could be to exclude other sea users from up to 490 km<sup>2</sup> per day, or less than 2% of the IOSEA1 area.

There are no detailed fishing effort data currently available with which to compare these physical presence impacts directly. Within the IOSEA1 area, the fishing industry may be of closest relevance to the oil and gas industry in comparing levels of exclusion to other sea users (and possibly also disturbance to the sea bed in combination with drilling discharges to the sea bed). However, as discussed in Section 7 in relation to levels of shipping and to previous seismic vessel activity, and in Section 8 with regard to drilling activity, the impacts of the physical presence of these various users in the IOSEA1 area do not change significantly when considered in combination.

### 9.5.5 Transboundary

There is little transboundary impact likely to arise from seismic vessel activity within the IOSEA1 area. However, the proposed activity may have the potential to interact with shipping travelling through the area to or from other European ports. In addition, it is possible that some of the seismic vessel activity in the IOSEA1 area will be based in ports in other European States.

## 9.6 Accidental events

### 9.6.6 Cumulative and transboundary impacts

Exploration activities forecast for the IOSEA1 area indicate a maximum of 19 exploration, appraisal and development wells will be drilled between 2008 and 2011. Based on the probabilities outlined for UK and Norwegian production, the incremental risk of a significant hydrocarbon spill is very low.

The cumulative level of hydrocarbons entering the marine environment from spills associated with exploration, appraisal and development drilling is likely to be negligible when considered against other natural and anthropogenic sources. While the impacts from oil spills will differ from those of hydrocarbon inputs from rivers, sewage and shipping for example, even large oil spills associated with tanker accidents do not appear to have had long term chronic impacts on marine ecosystems.

Transboundary impacts on the UK marine environment are considered to be the same or less than for Ireland. The island of Islay off the coast of Scotland is the closest UK landfall some 30 km to the east of the IOSEA1 area. Coastal sensitivities on Islay are high and are similar in nature to those of the north west of Ireland. The coast of Northern Ireland lies over 50 km south of the eastern edge of the IOSEA1 area.

Any oil spill likely to have impacts in UK waters will be reported by the Irish Coast Guard to the relevant UK authorities. The Irish Coast Guard has a close working relationship with the UK Maritime and Coast Guard Agency (MCA) and is currently finalising a Service Level Agreement for co-operation on search and rescue and oil spill response. Recently the Irish Coast Guard and the UK MCA concluded a joint search and rescue and oil spill response exercise off the Donegal coast.

Cumulative and transboundary impacts from a shallow gas blowout would be reservoir specific. Atmospheric emissions could potentially have cumulative effects, although they would be dependent on the type and volume of gas released into the atmosphere. Similarly transboundary impacts could possibly occur with the UK and other European States.