ASSESSMENT OF ADVERSE NON-POLLUTION EFFECTS FOR OFFSHORE PETROLEUM PRODUCTION AND PIPELINE DEVELOPMENTS

February 2007

Final Report

For the Department of Trade and Industry

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ASSESSMENT OF ADVERSE NON-POLLUTION EFFECTS

1. Introduction

The Department of Trade and Industry (DTI), as regulator for the offshore oil and gas industry, commissioned the Environmental Impact Assessment Centre to undertake an independent research study to *"determine whether applicants and the Department are adopting a consistent and acceptable approach"* to the preparation and assessment of Environmental Statements (ESs) *"that fully meets the requirements of the Environmental Impact Assessment (EIA) Regulations and the related, parent, EU Directives*[1]*"*. The study focused on EIAs undertaken under the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (SI 1999 No. 360) and covered the period 2002-2005.

The study had two objectives:

I. To evaluate the preparation and assessment of offshore ESs,

II. To identify and list potential adverse non-pollution effects and proposed mitigation measures.

This report focuses on Objective II and considers the adverse non-pollution effects identified and the mitigation measures proposed to address them.

2. Methodology

At the study inception stage the study team met the DTI contract officer and other DTI personnel, to discuss the identification of adverse non-pollution effects. In order for the analysis to be consistent and systematic, it was important that the study of non-pollution effects followed a common format. This related both to the types of effects covered by the objective, and recording them, and their associated mitigation measures – including the assessment of alternatives. A simple recording sheet was prepared, supplemented by a list of the types of effects; see Appendix A. (Supplementary questions relating to relevant Strategic Environmental Assessment (SEA) studies, also commissioned by the DTI, were also appended to this form.)

A sample of ESs submitted under the Regulations was selected for detailed review of the adverse non-pollution effects. This sample was chosen to reflect:

- different timeframes since 1 January 2002 (year of submission)
- different types of project
- different levels of experience in preparing ESs for offshore schemes, indicated by the relative numbers of ESs prepared by different operators, including those who had submitted five or more ESs (classed as 'major'), those that had submitted three to four ESs (classed as 'medium'), and those that had submitted only one or two (classed as 'small')
- Different geographical zones

Data provided by the DTI confirmed that 82 ESs were submitted to DTI during the period 2002-2005. The intention was to analyse approximately 50% of the

[1] European Commission (1985) Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment. *Official Journal of the European Communities* L175: 40, 5 July 1985, and European Commission (1997) Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment. *Official Journal of the European Communities* L73: 5-15, 14 March 1997

total of 82 ESs, depending upon availability, and the final sample constituted 43% (35) of the total. Projects that had not completed the application and determination process were excluded. Table 1 shows the distribution of all ESs and the sample, according to year of submission, project type, operator experience and geographical zone. The same ESs were also used for the Objective I review of ES quality.

Table 1: Characteristics of all ESs and the sample

	Available ESs = 82		**Sample of ESs = 35**	
Year				
2002	22	27%	11	31%
2003	13	16%	7	20%
2004	30	37%	11	31%
2005	17	21%	6	17%
Project type				
Exploration wells	19	23%	9	26%
Field developments	61	74%	24	69%
Pipelines	2	2%	2	6%
Operator experience				
Major	15	18%	10	29%
Medium	32	39%	14	40%
Small	35	43%	11	31%
Geographical zone				
North East North Sea	40	49%	16	46%
Southern North Sea	26	32%	11	31%
Eastern Irish Sea	7	9%	4	11%
West of Shetland	9	11%	4	11%

The evaluation of non-pollution effects was undertaken by six selected postgraduate students undertaking the MA degree programme in EIA & Management at the School of Environment and Development, University of Manchester. Subsequent analysis of their findings was undertaken by members of the research team.

Each of the ESs was scrutinised for its coverage of adverse non-pollution effects and associated mitigation measures. During the study inception stage, a protocol was developed for this evaluation, including guidance as to what constitutes a 'non-pollution effect'. The evaluation therefore considered the following:

- Ecology
- Cultural heritage
- Economic
- Traffic (including fishing vessels)
- Other.

Each was then examined with regard to the following attributes:

- Physical presence
- Physical disturbance
- Visual
- Noise
- Vibration
- Waste
- Other

3. Analysis

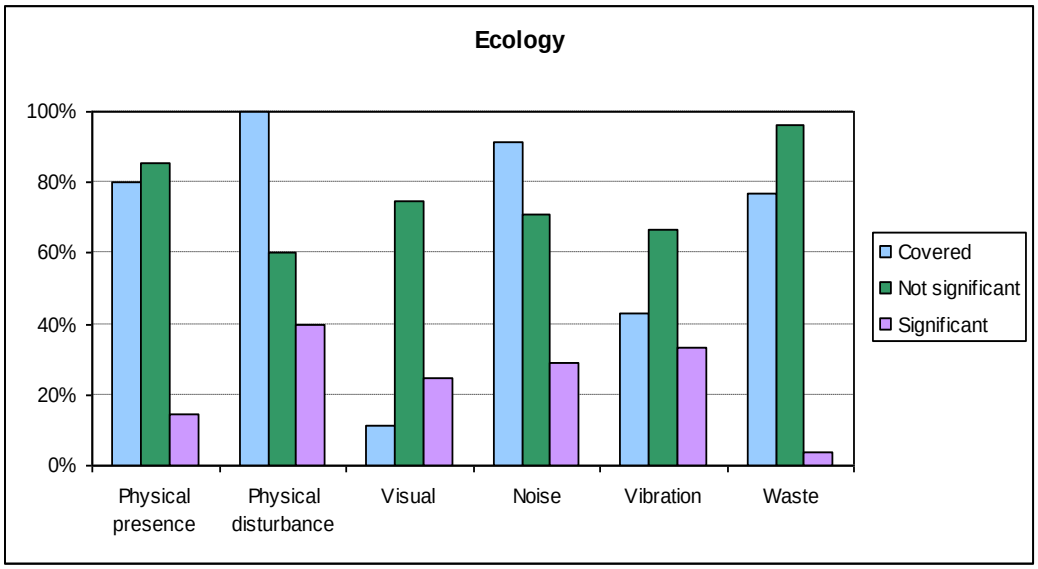
The 35 ESs analysed provided a representative sample for the evaluation of non-pollution effects. In addition to indicating how the various non-pollution effects were addressed, the analysis also explored the treatment of mitigation measures, including the consideration of alternatives.

3.1 Non-Pollution Effects

3.1.1 Ecology

Ecology includes both the habitat and the flora and fauna which may be affected either directly or indirectly by the projects. It can relate to habitats and populations *in situ* (for example, *Sabellaria* reefs), and to pelagic organisms such as cetaceans and fish.

Figure 1



Impacts on ecology were always addressed in relation to the potential physical disturbance, although in most ESs (60%) it was concluded that these effects were unlikely to be significant. In the majority of ESs, the impacts of noise (91% of ESs), physical presence (80% of ESs) and waste (77% of ESs) upon ecological receptors were also assessed and again effects were regarded as unlikely to be significant (71% of ESs for noise; 86% of ESs for physical presence; and 96% of ESs for waste). Vibration was considered in less than half of the ESs (43%), and regarded as potentially significant in one third of these ESs. Visual impacts on ecological receptors were assessed in only four of the ESs, and in only one were effects regarded as likely to be significant.

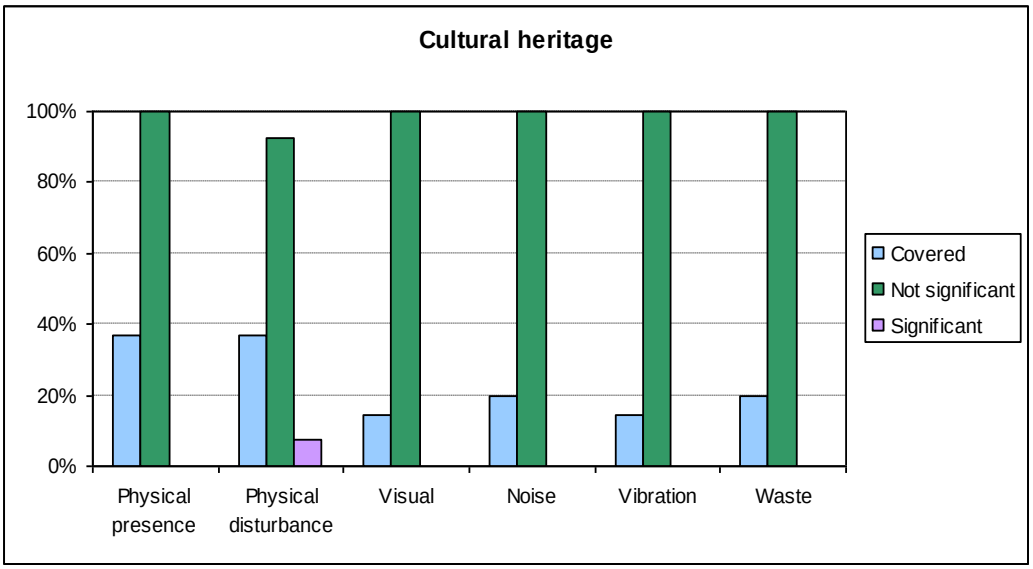
Other possible impacts on ecology were considered, including those from spills (four cases), air quality (three cases), lighting, flaring and dropped objects, and in the context of cumulative and transboundary impacts.

Effects on ecology were considered to be most relevant during the construction phase, followed by the operation phase, and more rarely during decommissioning. The exception was the likely impact of waste on ecology, which was normally considered, implying a greater relevance, for the operation phase.

3.1.2 Cultural heritage

Cultural heritage includes architectural and archaeological features of importance, and relates primarily to wrecks that may be damaged or disturbed.

Figure 2

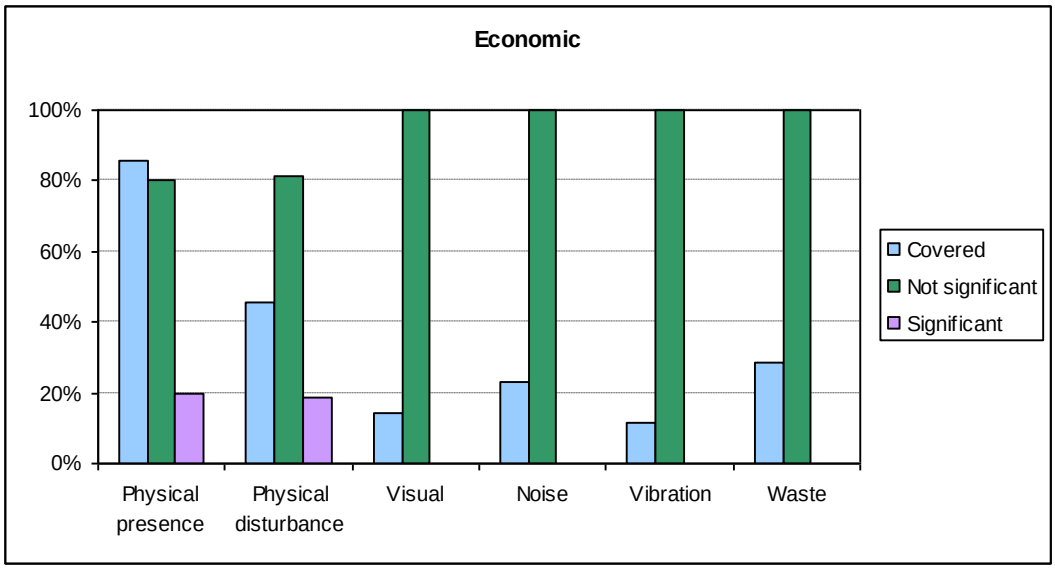


Impacts on cultural heritage were more rarely addressed, and then mainly in relation to physical presence and physical disturbance (37% of the ESs) during both the construction and operation phases. In only one project were such effects on cultural heritage regarded as likely to be significant. The effects on cultural heritage of visual impacts, noise, vibration and waste were only addressed in approximately one fifth of the ESs, and in all cases the potential impacts were regarded as unlikely to be significant.

3.1.3 Economic

Economic factors relate primarily to socio-economic impacts, including effects on fishing and other activities.

Figure 3



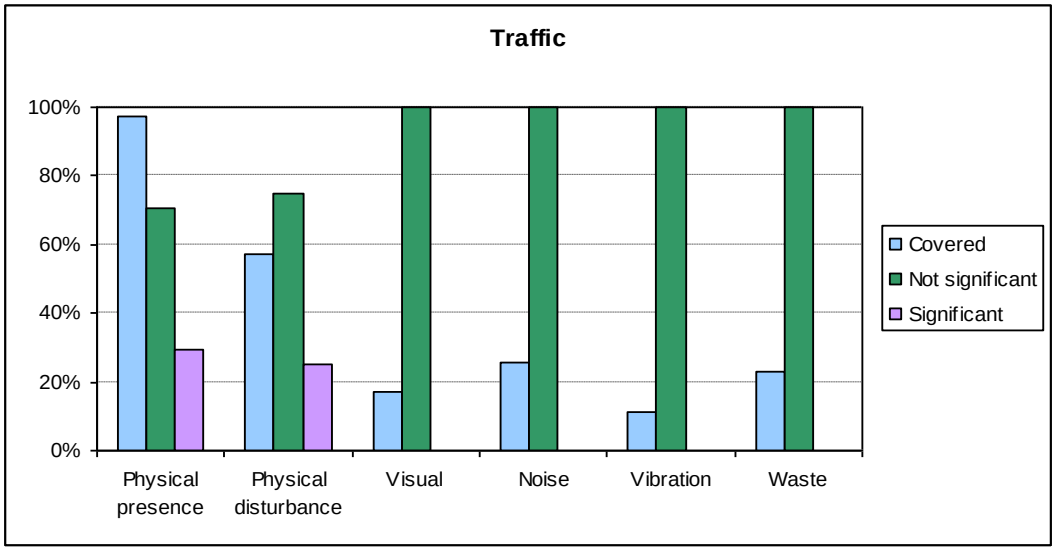
Impacts on economic factors were addressed in the majority of the ESs (86%), primarily in relation to the physical presence during the construction and operation phases, but in one fifth of ESs they were also assessed in relation to the decommissioning stage. Only in a minority of ESs (20%) were effects regarded as potentially significant.

Physical disturbance impacts were assessed in just under half of the ESs (46%) and, again, in approximately one fifth of the ESs the impacts were regarded as potentially significant. Where the effects on the economy of noise and waste were considered (23% and 29% of ESs respectively), none of the effects were regarded as potentially significant. Visual impacts and vibration were rarely considered (14% and 11% of ESs respectively), but were again not regarded as significant.

3.1.4 Traffic

Traffic effects include impacts on shipping and fishing traffic.

Figure 4



Only one ES did not cover the impact of the project on shipping and/or fishing traffic caused by the physical presence. Of the remainder, approximately one third of the ESs anticipated significant potential impacts. Physical disturbance effects on traffic were addressed in over half of the ESs (57%), with one quarter of the impacts considered to be potentially significant. The physical impacts identified were mainly related to the construction phase, followed by those related to the operation phase. Just under one fifth of the ESs considered the impacts related to decommissioning.

The noise and wastes impacts on traffic were covered in approximately one quarter of the ESs, with visual and vibration impacts covered more rarely. None of these impacts were considered likely to be significant.

3.1.5 Other effects

Very few 'other' non-pollution effects were identified in the ESs. The impacts considered were the:

- consequences of land disposal of waste; highlighted in six ESs,
- impact of physical disturbance on sediments,

- visual and noise impacts on the coastal population.

In only one third of cases were these additional impacts considered likely to be significant.

3.2 Project attributes

In addition to drawing out the possible areas of impact of the projects, the ES review also shows which attributes of the projects were considered likely to have most impact.

The **physical presence** of projects was addressed in the majority of ESs, although comparatively few considered its effect on cultural heritage, but the effects were generally judged as not significant. However, it was accepted that there could be an effect on shipping and/or fishing traffic, with significant impacts on traffic predicted for just under one third of the projects.

Physical disturbance was always considered for its impact on ecology, and significant effects on ecology were predicted for 40% of the projects. Impacts on cultural heritage, economic issues and traffic were only addressed in approximately half the ESs, with very few potential impacts regarded as significant.

The **visual** impact of projects was considered in only a handful of ESs, and was only regarded as potentially significant for one project - a field development project in 2002.

The **noise** during construction, and also during the operational phase, was assessed in relation to effects on ecology, with significant impacts predicted for a quarter of the projects. The impact of noise on cultural heritage, economic issues and traffic was considered for just under a quarter of the projects.

Vibration was rarely addressed; and only tended to be covered in relation to ecology, with few significant impacts predicted.

The impact of **waste** again focused on effects for the ecology, although these were only regarded as significant for one project – an exploration well drilled in 2002. The impact of waste on cultural heritage, economic issues and traffic was only considered for approximately one quarter of the projects.

3.3 Consideration of alternatives

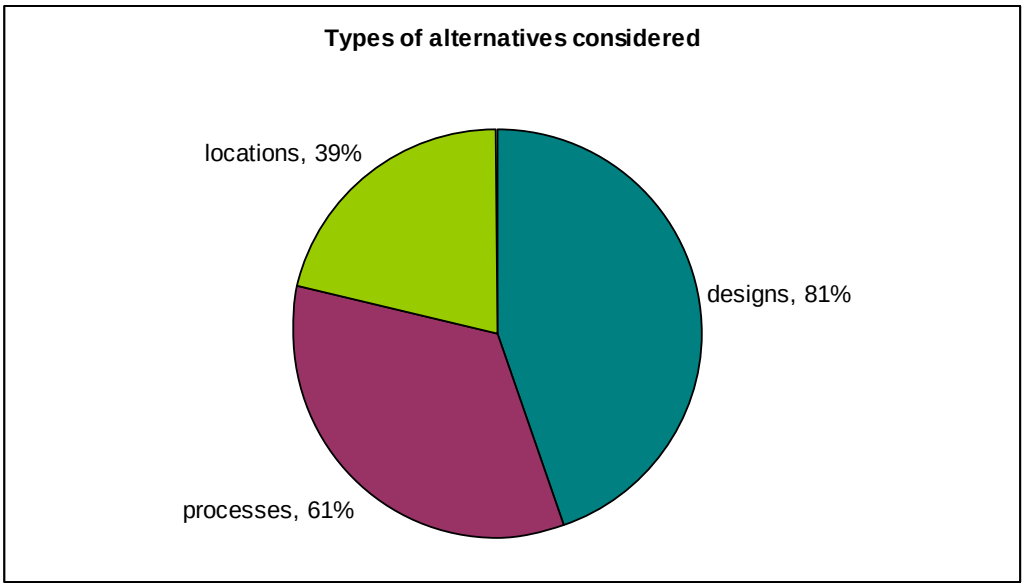
The consideration of alternatives is a key part of the early stages of the assessment process and should be linked to project design. The choice of alternatives sites, designs, processes, etc, can also be an important means of minimising impacts, and thus merits consideration as a mitigation measure.

3.3.1 Types of alternatives

Only four of the 35 ESs made no mention of any type of alternative. Three of these ESs were produced in 2005, three were for exploration wells. Two were submitted by 'small' and two were submitted by 'medium' experience operators. There was no consistent pattern in relation to geographical zone, although two of the four ESs relating to the Eastern Irish Sea, and one of the four ESs relating to the West of Shetland, did not cover any alternatives.

Alternative designs were considered most often – twice as frequently as alternative locations. Just under half of the ESs considered both alternative designs and processes, just under one third both designs and locations, and just under one fifth both locations and processes. Only five ESs included coverage of all types of alternatives, and all were for field development projects (by two medium and three major experience operators). Of the 11 ESs that only considered one type of alternative, just over half focussed on alternative designs.

Figure 5



Particular project types were generally associated with certain types of alternative. Pipelines were more likely to consider alternative locations; exploration wells were more likely to consider alternative processes, and field developments were more likely to consider alternative designs.

There was no apparent pattern in relation to the consideration of particular types of alternatives over time, although the majority of the 11 projects which considered only one type of alternative – whether location, design or process – were submitted during the early years of the study sample, with six examples from 2002, and three from 2003. However, in addition, it was noted that no alternative locations were considered in 2005.

Relationships were noted between the consideration of particular types of alternatives and the geographical zone in which the projects were located. ESs for projects in the North East North Sea were more likely to consider alternative designs, and eight of the ten ESs that explored both alternative designs and processes were located in the North East North Sea. Similarly, three of the six ESs that focussed solely on design alternatives were in the Southern North Sea. Alternative processes appeared to be considered more often for the West of Shetland zone.

3.3.2 Resolution of choices between alternatives

Where projects considered alternative locations, there was broadly widespread use of environmental (67% of ESs), technical (75%) and economic (75%) factors in making the choices. A similar trend was noted for choices between alternative designs; environmental (60%), technical (68%) and economic (60%). However, technical factors were dominant for both alternative locations (75% of ESs) and alternative designs (68% of ESs). Where choices between alternative processes

were considered, again these were more likely to be resolved on technical grounds (79% of the ESs) as opposed to environmental (53%) or economic (58%) grounds.

Trends in the use of environmental, technical or economic grounds for the different **types of project** were more difficult to discern, due to the high proportion of field developments in the sample (reflecting the overall population of ESs). Nevertheless, it was clear that pipelines tended to resolve choices based on technical and economic grounds, whereas choices for exploration wells were predominantly resolved on environmental grounds. Field development choices used all three factors, with technical and economic grounds being the most popular.

Trends over **time** showed that both technical and economic grounds were used more consistently during the sample period, but environmental grounds were used intermittently.

Operator experience seemed to play a role in choosing between different types of alternatives. Operators with relatively less experience generally used a combination of environmental, technical and economic grounds when considering alternative locations, designs and processes; although environmental grounds were less prevalent in relation to alternative process choices. Operators with 'medium' and 'major' experience were more likely to use technical grounds when making choices. Economic grounds were used more rarely when 'medium' experience operators were choosing between designs, and when 'major' experience operators were choosing between processes. 'Medium' experience operators also rarely used environmental grounds when choosing between different processes.

Consideration of the **geographical zone** in which the projects were located indicated that environmental, technical and economic grounds were used fairly consistently in the Southern North Sea when choosing between alternatives. Environmental grounds were used less often in both the North East North Sea and West of Shetland. Technical grounds were rarely used in the Eastern Irish Sea. Economic grounds were used less in the West of Shetland zone than in the other geographical zones.

3.4 Mitigation measures

The mitigation measures proposed in the ESs were analysed in relation to the six project attributes, namely physical presence, physical disturbance, visual impacts, noise, vibration and waste. In addition, mitigation measures proposed for other impacts were also analysed. The mitigation measures proposed for each attribute are indicated, together with any trends noted by year of submission, project type, operator experience and geographical zone. The most commonly proposed mitigation measures are listed, and additional mitigation measures for each attribute are included in Appendix B.

3.4.1 Physical presence

An overwhelming majority of the ESs in the sample (94% or 33 of the 35 ESs) proposed mitigation measures in relation to the physical presence of the projects. No trends in terms of the year, type of project, operator experience or geographical zone were noted.

The most commonly proposed mitigation measures were:

- 500m exclusion zone patrolled by a vessel and/or radar (26 ESs, plus one ES proposing a 3km^2 exclusion zone;
- Notification of, and consultation with, other sea users, including marking position of infrastructure on charts, and producing charts and reporting vessel movements (19 ESs);
- Fishing-friendly design to ensure free movement of trawlers over pipelines and umbilicals (11 ESs - mainly field developments);
- Continuous monitoring of vessels (7 ESs).

3.4.2 Physical disturbance

Twenty six of the ESs (74%) proposed mitigation measures in relation to the physical disturbance caused by the projects. There were no trends over time, but exploration wells appeared less likely (56%) to incorporate mitigation measures for physical disturbance than both field developments (79%) and pipelines (100%). Projects in the Southern North Sea (55% of ESs) and Eastern Irish Sea (25% of ESs) also appeared to be less likely to incorporate proposed mitigation measures than projects in the North East North Sea (81%) and West of Shetland (100%). Those operators with 'medium' experience seemed less likely (64%) to propose mitigation measures for any physical disturbance caused by the projects than those with 'major' experience (80%) and relatively less experience (91%).

The most frequently stated mitigation measures to minimise physical disturbance were:

- Working areas and corridors minimised (9 ESs);
- Reducing anchor mound formation and management of use of anchors (7 ESs);
- Use of dynamically positioned vessels to avoid seabed scars (7 ESs – 6 field developments and 1 exploration well);
- Post lay/trench pipeline survey or decommissioning surveys (6 ESs);
- Rock dumping restricted to small areas (4 ESs);
- Using charts, notification, liaison with sea users (4 ESs);
- Application of various pipeline laying techniques (4 ESs);
- Use of alternative chemicals and muds (4 ESs).

3.4.3 Visual impacts

None of the 35 ESs in the sample contained any mitigation measures in relation to potential visual impacts arising from any of the projects.

3.4.4 Noise

A minority of 14 ESs (40%) proposed mitigation measures in relation to noise impacts. Again no trends over time were apparent. In terms of the project types, just over half (56%) of the exploration wells included noise mitigation measures, followed by over one third (38%) of the field developments, and none of the pipelines. All four projects West of Shetland proposed mitigation measures as opposed to none of the four projects in the Eastern Irish Sea. Projects in the North East North Sea and Southern North Sea proposed noise mitigation measures in 38% and 45% of ESs respectively. There were no trends relating to the relative experience of the operators concerned.

The main mitigation measures for noise impacts included:

- Minimise duration of works and movement of vessels (5 ESs);
- Operation of well maintained vessels and equipment (4 ESs);

- Regulation of vessels' stationing, speed and course (4 ESs).

3.4.5 Vibration

Only two ESs proposed mitigation measures in relation to vibration impacts, and they were for more recent projects, namely a field development in 2005, and an exploration well in 2004. The projects were located in the North East North Sea and the Southern North Sea respectively. Interestingly, the operator in each case was regarded as having relatively little experience.

3.4.6 Waste

Thirty ESs (86%) included mitigation measures for waste impacts, with an increase in inclusion over time from 73% of the ESs in 2002 to all of the ESs in 2005. The majority of the field development ESs (92%) contained mitigation measures for waste, with just over three quarters of the exploration wells (78%), and only half of pipelines. There was no apparent trend in relation to the geographical zones or operator experience.

The most commonly proposed mitigation measures were:

- Disposal onshore at designated landfills (15 ESs);
- Waste management systems/plans (11 ESs);
- Re-use/recycle (11 ESs);
- Treatment on-board ship or onshore (7 ESs);
- Treatment prior to discharging to sea (6 ESs);
- Audits and compliance with regulations (5 ESs).

3.4.7 Other impacts

Just over one third of the ESs (34%) included mitigation measures to deal with other impacts. There was no trend over time and no clear differences between the project types. However, projects in the Eastern Irish Sea were least likely to include such mitigation measures for other impacts, whilst those from West of Shetland were more likely to propose such mitigation measures. There was also a slight trend for more experienced operators to propose mitigation measures for such impacts (27% of operators with little experience; 36% of 'medium' experience operators; 40% of 'major' experience operators).

Mitigation measures mentioned for other impacts included:

- Oil spill contingency plans (5 ESs);
- Environmental, Health and Safety Management System (3 ESs);
- Monitoring plans (for pipelines, wells and flaring) (3 ESs).

4. Conclusions

The second objective of the study of EIAs undertaken under the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999, was to identify and list potential adverse non-pollution effects and associated mitigation measures.

4.1 Non-pollution effects

A sample of 35 ESs (representing 43% of the 82 ESs submitted between 2002-2005) was evaluated to establish the types of non-pollution effects being assessed, the associated mitigation measures and the consideration of

alternatives. The findings were considered in relation to trends by date of ES, geographical zone, and operator experience.

The main non-pollution effects identified were:

- Ecology
- Cultural heritage
- Economic
- Traffic
- Other, such as
    - Land disposal of waste
    - Impacts on sediments
    - Impacts (visual and noise) on coastal population

Ecological effects were addressed most frequently, and mainly in relation to the physical presence of projects, their physical disturbance, noise and waste emissions. Economic and traffic effects were addressed less often and usually in relation to the physical presence and physical disturbance. Cultural heritage was rarely addressed. Of the 'other' effects, the consequence of land disposal of waste was the most commonly considered issue (but in only six of the 35 ESs).

Visual impacts and vibration were rarely addressed in relation to any of the non-pollution effects. Where vibration was addressed, it was in relation to ecology.

Overall, non-pollution effects did not tend to be regarded as significant, other than for impacts on ecology, particularly in relation to the physical presence and any physical disturbance caused by the project.

4.2 Alternatives

The majority of the ESs (89%) addressed alternatives, with a particular focus on alternative designs (81% of the ESs), followed by alternative processes (61%) and then alternative locations (39%). Only five of the ESs considered alternatives in all three areas.

Particular project types were generally associated with certain types of alternative. Pipelines were more likely to consider alternative locations; exploration wells were more likely to consider alternative processes, and field developments were more likely to consider alternative designs.

The consideration of both alternative designs and processes seemed to be associated with projects in the North East North Sea zone, whilst alternative processes were considered more often in the West of Shetland zone.

Perhaps unsurprisingly, the choice between alternative processes tended to be made on technical grounds, whereas a more balanced approach – using technical, environmental and economic grounds - was used for choices between alternative locations or alternative designs.

4.3 Mitigation

The identification of common mitigation measures for particular non-pollution effects proved difficult as, generally, mitigation was proposed in relation to particular project attributes. Thus nearly all the ESs (94%) proposed mitigation measures in relation to the physical presence of the projects, and the measures proposed included exclusion zones, consultation with other sea users, design changes, and monitoring. Measures relating to physical disturbance and waste

were reasonably common (74% and 86% of ESs respectively), but measures relating to noise and 'other' impacts were less common. Only a few mitigation measures were proposed for vibration and none at all for visual impacts.

Overall, there appeared to be a focus on impacts on ecology due to the physical characteristics of projects, with more limited consideration of other non-pollution effects and implications of the projects.

Some differences and trends related to project types, operator experience, geographical zone of operation and timescale were apparent, but overall the approach to EIA was not markedly different.

Mitigation measures proposed were usually related to specific project characteristics.

APPENDIX A – NON-POLLUTION EFFECTS RECORDING FORM

DTI Offshore Oil and Gas EIA Research Study

Checklist for Non-pollution Effects, Alternatives and Links to SEA

ES Reference:

ES Title:

Reviewer:

1. Coverage of Alternatives

a. Are alternatives discussed in the ES? (tick as appropriate)

- No alternatives
- Locations
- Designs
- Processes

b. How are the choices between alternatives resolved (tick as appropriate)?

Alternative locations:

- On environmental grounds
- On technical grounds
- On economic grounds
- Not clearly resolved

Alternative designs:

- On environmental grounds
- On technical grounds
- On economic grounds
- Not clearly resolved

Alternative processes:

- On environmental grounds
- On economic grounds
- On technical grounds
- Not clearly resolved

2. Does the ES refer to any SEA reports? If so please note below the section of the ES containing the reference, and the title of the SEA study involved.

3. Non-pollution significant adverse effects and associated mitigation

a. Coverage of impact areas (NC= not covered; NS=no significant impact; S=significant impact; C=construction; O=operation ; D=decommissioning)

	Ecology	***Cultural Heritage***	***Economic***	***Traffic***	***Other(specify)***	***Mitigation proposed (specify)***
Physical presence						
Physical disturbance						
Visual						
Noise						
Vibration						
Waste						
Other (specify)						

APPENDIX B – OTHER MITIGATION MEASURES

See Section 3.4 for key mitigation measures proposed.

Physical presence
- All vessels/installations associated with projects to carry relevant navigational and communication aids (4 ESs, only for field developments);
- Maximum use of existing infrastructure and already developed areas, sharing of vessels, helicopters and other facilities (3 ESs);
- Management of traffic (3 ESs);
- Collision risk management (3 ESs);
- Short time period for work (2 ESs);
- Post-installation surveys (2 ESs);
- Post-construction or decommissioning removal of debris and structures (2 ESs);
- Compensation for loss of earning of commercial fisheries (1 ES);
- Seabed survey to avoid environmentally sensitive areas (1 ES);
- Subsea equipment within 'dropped object zones' protected by concrete mattresses where not trenched (1 ES);
- Survey of ship position during works (1 ES);
- Laying pipeline on sea bed (not trenching) (1 ES);
- Use of a fall pipe on the dump vessel and a Remotely Operated Vehicle (ROV) to ensure accurate placement (1 ES).

Physical disturbance
- Decommissioning considered (3 ESs);
- Transportation, treatment and disposal of cuttings and muds on-shore (3 ESs);
- Supervision of operations, including rock dumping (3 ESs);
- Best practice methods employed (2 ESs);
- Avoidance of environmentally sensitive areas (2 ESs);
- Minimisation of movements (2 ESs);
- Control/removal of dropped objects (2 ESs);
- Dispersion of cuttings (2 ESs);
- Minimal time period for work (2 ESs);
- Obtaining licenses (1 ES);
- Re-injection of cuttings (1 ES);
- Avoidance of pipelines (1 ES);
- Avoidance of pockmarks (1 ES);
- Post-lay intervention work through chain drags (1 ES);
- Timing of works (1 ES).

Noise
- Helicopters to maintain a minimum altitude, avoid circling and hovering over marine mammals (2 ESs);
- Observation of marine mammals (2 ESs;
- Utilisation of established routes (1 ES);
- Timing of works (1ES);
- Number of vessels kept to a minimum (1 ES);
- Use of submerged turret loading system will minimise the use of 'dynamic positioning' for vessel (1 ES);
- Use of sunken (drilled) piles (not pile driving) (1 ES).

Waste
- Use of low toxicity chemicals (3 ESs);
- Well maintained and operated equipment (2 ESs);
- Bunding of liquid storage containers (2 ESs);
- Awareness raising (1 ES);
- Use of low-sulphur fuel (1 ES);

- Flaring excess gas rather than venting (1 ES);
- Bunding of oil/separated from waste water (1 ES);
- Discharge in small volume batches (1 ES);
- Risk assessment for waste disposal (1 ES);
- Hazardous wastes carefully stored and used and detailed inventory kept (1 ES);
- Use of on-board shale shakers (1 ES);
- Careful calculation of volumes of chemicals (1 ES);
- Surveys (1 ES);
- Separation of drainage water (1 ES).

Other
- European EMAS standard certification (1 ES);
- Use of self-isolating facilities (1 ES);
- Application of procedures to minimise emissions and duration of well test (1 ES);
- Avoid transfer of utility fluids (1 ES);
- Re-fuelling only in daylight and in good weather conditions (1 ES);
- Use/implement dedicated well engineering info systems (1 ES);
- Adherence to procedures and use of certified equipment (1 ES);
- Retrieval of major items of debris from seabed (1 ES).