OIL 'RIG' DISPOSAL

- *Comparing the environmental impacts of disposing of Brent Spar on land and at sea.*
- *The 'best practicable environmental option'.*
- *Implications of recent events.*

The controversy over the proposed disposal in deep water of the Brent Spar storage buoy reveals disagreement over the environmental impact of sea disposal and how this is taken into account in deciding the Best Practicable Environmental Option for disposing of redundant N Sea installations.

This note examines environmental impacts from disposing of oil platforms etc., and the issues raised[1].

POST note 65 July 1995

POSTnotes are intended to give Members an overview of issues arising from science and technology. Members can obtain further details from the PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (extension 2840).

ASSESSING ENVIRONMENTAL IMPACTS

Dismantling and Disposal on Land

Before an installation can be dismantled on land it needs to be brought ashore. Any ballast water or other sources of contamination must be removed and treated before disposal. Adequate safeguards are required to prevent pollution of coastal or estuarine waters.

Environmental benefits arise from onshore disposal chiefly in the raw material and energy savings from recycling scrap metals. Different environmental, health and safety issues arise for different aspects of the operation. Key aspects include:

- Dismantling larger structures presents physical dangers to workers, and health risks can arise from removing asbestos (e.g. in fire-proofing). Other safeguards are necessary against inhaling dust from scale which may contain radioactive elements naturally present in the oil reservoir[2].
- Waste materials require careful and controlled handling. Concrete and other non-recyclable materials (e.g. wood, plastic and glass) can be disposed of in a licensed landfill site. Oily residues and sludges may need to be incinerated. The LSA scale in pipework and elsewhere may classify scrap or sludges as low-level radioactive waste and require transport to Dounreay or Drigg for disposal.
- Cutting up large structures uses large amounts of energy and generates noise, fumes and dust.

Disposal at Sea

Scientific research in the 1960s first turned the spotlight on the possible environmental consequences of dumping wastes at sea, and underpinned pressure for international regulation, which emerged in 1972 via the Oslo Convention (North Sea and North-east Atlantic), and London Dumping Convention (covering the whole world). The Conventions were enacted in the UK via the Dumping at Sea Act 1974 (now the 1985 Food and Environmental Protection Act -FEPA) and fisheries departments are responsible for evaluating the environmental impacts of proposals to dump waste materials and for the necessary licensing schemes[3]. Predicting the possible impacts of waste on the marine environment broadly consists of evaluating the characteristics of the waste (physical, chemical, biochemical and biological properties; toxicity; persistence and potential for bio-accumulation in marine organisms); effects on living resources, public health and amenity; and issues raised by the proposed method or site of disposal.

When the Oslo convention was first introduced there were substantial quantities of waste dumped by several coastal states in all three categories of industrial waste, sewage sludges and dredged spoils. However, increasingly, scientific assessments of the acceptability of dumping at sea have been overlain by the 'precautionary principle' and a philosophy that wastes should be disposed of on land wherever possible. This trend has been strengthened by agreements at the North Sea Conferences and has led to industrial waste dumping being phased out altogether this year, and agreement reached to phase out sewage sludge by 1998. After that date the only waste disposed of routinely at sea will be dredgings (from ports etc.).

This was the backdrop against which more specific rules and guidance were developed for oil and gas platform decommissioning and disposal. Rules developed under the Oslo and Paris Conventions apply to the North Sea, and specify that all actions shall be licensed and decided on a case-by-case basis; also that:-

- No permit shall be issued if the installation contains substances which result or are likely to result in hazards to human health, harm to living resources and marine ecosystems, damage to amenities or interference with other legitimate uses of the sea.
- Other contracting parties should be consulted.

Additional global guidelines focusing primarily on the navigational safety aspects come from the International Maritime Organisation (IMO) and include:-

- In water depths of less than 75 metres (100 metres after 1998), all installations weighing less than 4,000

1. This note is complementary to Library Briefing 95/77, which examines *inter alia*, the international regulatory environment for disposal.

2. Low specific activity (LSA) scale forms on the insides of ballast or storage tanks in a similar manner to limescale in plumbing. However in this case, the salts involved contain low levels of naturally-occurring radioactive elements.

3. Ministry of Agriculture, Fisheries and Food - MAFF (England and Wales); Scottish Office Agriculture and Fisheries Dept (SOAFD).

tons should be entirely removed.

- For deeper / heavier installations, partial removal is permitted; where left wholly or partly in place, the potential effects on the marine environment evaluated should include effects on water quality; the potential for pollution or contamination of the site by residual products from, or deterioration of, the installation; and interference with other uses of the sea such as fishing, shipping, cable laying etc.

THE BPEO FOR DISPOSAL

Environmental protection policy in the UK applies the principle of **Best Practicable Environmental Option (BPEO)** which seeks to eliminate or minimise releases of harmful substances to the environment **as a whole**, while taking account of safety, practical feasibility and costs. Options for decommissioning and disposing of oil and gas installations include:

- complete removal to land disposal and recycling;
- complete removal to shallow or deep-sea disposal;
- partial removal - leaving only the lowest parts of the supports ('the stump') in place - the rest to land or shallow or deep-sea disposal;
- emplacement or toppling - severing the top section, which is placed (or allowed to fall) alongside the stump, leaving at least 55m clearance to the surface.

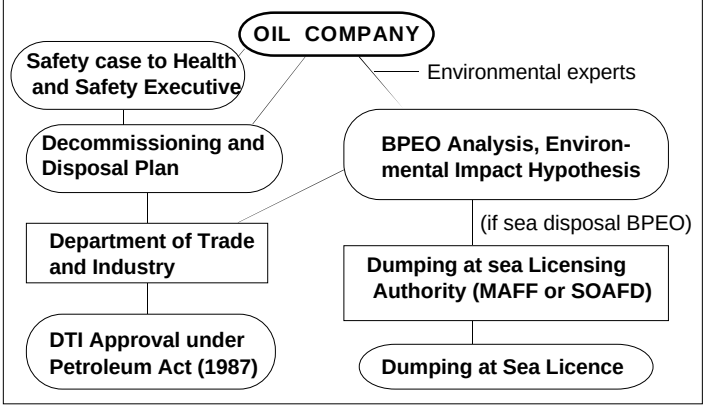
Deciding the BPEO is a complex procedure. The activities involved are set out in detail for each of the options under consideration. A comparative assessment is then made for the environmental impacts on air, water and land, the technical steps and risks involved, the health and safety implications, the financial costs and any other relevant factors.

Where the BPEO involves disposal at sea, the main approvals would follow the pattern illustrated in **Figure 1**, involving MAFF/SOAFD and DTI as the primary regulators, each having to issue a licence - DTI for the overall "abandonment programme"; MAFF or SOAFD for any dumping involved. Many other agencies and organisations would be involved in consultation or on specific aspects (e.g. disposal of LSA).

THE SPECIFIC CASE OF BRENT SPAR

Brent Spar was a floating storage buoy, commissioned in 1976, comprising an above-water helideck and accommodation and equipment decks, over a submerged oil storage cylinder with buoyancy tanks and ballast (**Figure 2**). Its six storage tanks could hold up to 50,000 tonnes (tes) of oil and the overall height is 137m. In terms of original construction materials, it comprised nearly 7,000 tes of concrete and haematite (iron ore) ballast, and 7,500 tes of steel, giving a total weight of 14,500 tes. Since taken out of operation in 1991, the superstructure has been stripped down, movable items taken off, and the storage tank drained of oil and refilled

FIGURE 1 PROCEDURE FOR DISPOSAL PLAN APPROVAL



with sea water. The current contents of the tank are thus a residual oily sludge which could not be pumped out, the sea water and additives (glyoxal for removing hydrogen sulphide), and contaminants which have dissolved into the sea water (e.g. oil from the sludge, zinc from sacrificial anodes used to control corrosion of the tank). Some key components of the detailed inventory on which Departments based their assessment of environmental impact and BPEO are listed in **Table 2**.

The burden of demonstrating the BPEO to the regulatory authorities falls to the facility operator and Shell commissioned over 30 separate studies to consider the technical, safety and environmental implications of disposal, including 3 independent evaluations of the BPEO. These concluded that the environmental effects of deep-sea and land-based disposal were each negligible. Deep-sea disposal was the preferred option because it presented fewer safety risks, and was technically simpler and thus much cheaper. In addition, the environmental consequences of an accidental release or sinking during the operations needed would be greater in coastal waters than in the deep ocean (see **Box 1)**.

The DTI approved the abandonment programme on 20 December 1994, and the BPEO evaluation and Impact Hypothesis were sent to the Oslo and Paris Commissions on 16 February 1995 to notify contracting parties of the UK Government's approval of Shell's proposals. Final licences were issued in May and the Brent Spar was towed towards a disposal site in the north Atlantic, selected by SOAFD on the basis of a separate site assessment exercise to minimise environmental impact and avoid interference with other legitimate uses of the sea. Greenpeace launched a campaign centred on claims that the environmental impacts would be greater than stated, and opposition to deep-sea disposal followed from the Governments of Germany, Denmark Netherlands and Sweden. In the light of this opposition, a consumer boycott, and violence in Germany, Shell announced on the day before the buoy reached its final destination (June 20), that the company would seek to dispose of the structure on land, even though the company (and the UK Government) still believed deep-sea disposal to be the BPEO.

FIGURE 2 SCHEMATIC DIAGRAM OF BRENT SPAR

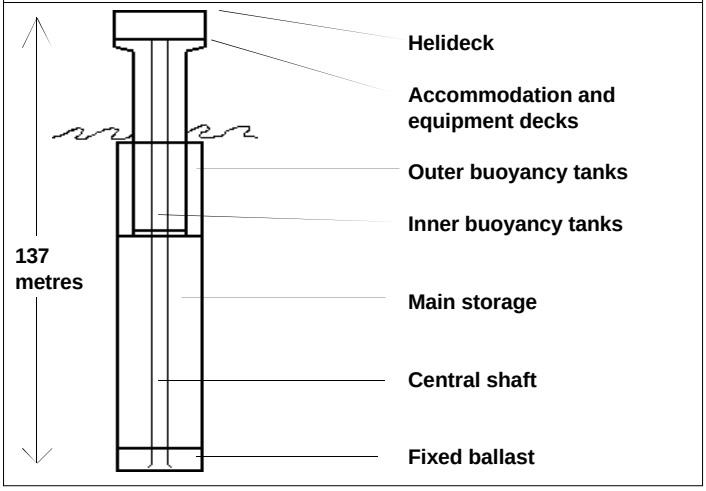


Table 2 MATERIALS REMAINING AT BRENT SPAR

Material	Weight in tonnes	Material	Weight in tonnes
Steel + other metals	7570	Haematite/Concrete	6800
Sand/Scale	90	Hydrocarbons	51
Aluminium	29	Zinc	14
Copper	14	Other heavy metals	less than 1
PCBs	0.0002	Total	14568

Greenpeace based its initial claims that a considerable threat existed to the marine environment on the same information as the licensing authorities. The latters' scientific assessment had however concluded that there would be a negligible environmental impact because:-

- The oily sludge[4] contained primarily the heavy (tarry) components of oil which are relatively inert;
- Contaminated seawater[4] leaking from the tank into the surrounding waters would be diluted, and direct toxic effects, if any, would be limited to within the immediate vicinity of the leak. The quantities of metals etc. in the water were insufficient to affect the quality of marine life in the area (which is in any case very sparse and not part of the human food chain).
- The main impact was essentially seen as physical, i.e. the equivalent to a wreck of a similar size, which would disturb the marine sediment and its organisms, but would weather and ultimately provide a new surface for fixed animals to grow on.

Greenpeace also expressed concern there had been no recent structural survey, and questioned whether the Spar would reach the seabed intact if dumped. SOAFD however point out that maintaining containment was not an important factor in the impact assessment.

When Greenpeace personnel boarded the rig, samples were taken which suggested the presence of thick layers of oil, rather than lightly contaminated seawater, and Greenpeace thus argued that the BPEO case had been based on inadequate information and the dumping licence should be reassessed. Shell has stated that the main tanks are inaccessible from above and believes that Greenpeace sampled vent pipes which had not been cleaned; the total amount of oil in these would be small and still within the amount declared on its original application. These discrepancies were being investigated by the licensing authorities until the decision was taken by Shell to cancel the dump, but the authorities had the necessary power to delay disposal while the discrepancies were resolved.

4. These were referred to by Greenpeace as "toxic sludge" and "lethal chemical cocktails" respectively.

Box 1 THE BRENT SPAR BPEO ASSESSMENTS

The BPEO assessments used in support of the decision to dump by the UK Government reviewed in detail the two leading candidates of horizontal dismantling and on-shore disposal, and deep water disposal. These two options compared as follows:-

Environmental Considerations. Horizontal dismantling should have negligible impacts on the marine environment, but if the structure failed during the stressful rotation of the buoy into the horizontal position, any contaminated ballast water released would enter the more sensitive coastal environment; equally, if the structure sank this would create a hazard to navigation and fishing. For deep water disposal, the environmental effects would also be negligible as the impacts were expected to be largely physical, i.e. burial of organisms; any local toxic effects on marine life due to contamination would be very localised and because of the low densities of organisms in the deep ocean, effects insignificant. The site was selected to avoid any danger of interaction with other uses of the deep ocean, e.g. fishing, submarine cables and military activities.

Safety and Risk Implications. Horizontal dismantling is much more labour-intensive, and involves complex and potentially hazardous operations. The risk analysis suggests that the probabilities of fatal injuries are some six times greater than those of deep water disposal. On-shore dismantling also involves potential exposure to the LSA scales, asbestos etc. and therefore requires strict health and safety controls throughout.

Engineering complexity and cost. The much greater engineering complexity of rotating the rig and dismantling it is reflected in the different initial cost estimates - £12 million for deep water disposal and £46 million for horizontal dismantling.

The BPEO thus concluded that the environmental impacts of each option were evenly balanced, but the health and safety considerations and engineering complexity and cost considerations strongly favoured the deep sea disposal option.

GENERAL ISSUES

The UK has placed consistent emphasis on developing flexible and pragmatic approaches to waste disposal under the broad philosophy that evaluating cases on their merits ensures the most benefit from the inevitably finite amounts spent on environmental protection. The Brent Spar experience however raises **questions over how far such 'rational' approaches can prevail where the final decision involves the sea** with its common use by many countries, and differing interpretations (e.g. of the precautionary approach) under international controls and regulations. There are a number of strands to this question.

Firstly, as already mentioned, the BPEO involves comparing impacts on different (land, sea, air) environments, and balancing local air pollution against, say, disturbance to deep-sea sediments is inevitably somewhat subjective. More quantitative means of assessing

environmental impact are being tried under FEPA, and by Her Majesty's Inspectorate of Pollution (HMIP), whereby numerical scores are assigned for the severity of the environmental effects; these can be combined with scores for costs and other risks to give an **Integrated Environmental Index (IEI)**. The approach with the lowest IEI would be the BPEO.

In theory, such approaches should ensure that the BPEO selected offers tangible benefits over other options without jeopardising the financial viability of the operation. However, it is exactly this blend of environmental protection with economic pragmatism that proves so difficult to 'sell' to campaign organisations and some other Governments, and the Brent Spar experience shows that existing means of disseminating the analyses and explaining decisions have not persuaded the public to resist calls to mount consumer boycotts, etc. The question follows therefore whether refining current methodology will change this.

As described above, the Brent Spar case has also fallen foul of disputes over the exact nature and quantity of contaminants on the structure. As licensing authority, SOAFD specified the information it required to make a proper assessment of environmental impact, and this was provided by Shell and independent analysts. The recently-disputed quantity estimates would have little effect on the impact hypothesis, but it is possible that more comprehensive data could have helped public understanding of the case. In this context, the licensing authority has powers to require samples to be taken, and these could have been used to measure the exact degree of contamination (rather than infer it), and also determine its toxicity to marine life via toxicity tests.

But underlying the whole debate are fundamental differences in the way in which the role of the sea is perceived in different countries. UK policy has been to see the sea as part of the overall environment to be protected and managed, but ever since the start of the Oslo Convention, it has been clear that some other countries consistently see the sea as a medium to be specially protected - if necessary to the point that its use for certain types of waste disposal should be barred altogether (e.g. for dumping of radioactive waste) or used only as an option of last resort. Thus, while the UK's approach to the decommissioning and disposal of oil and gas installations is **consistent** with international standards which allow for the possibility of deep-sea disposal where this is the BPEO, recent events show how far the scientific basis of BPEO is being challenged by a philosophical opposition to sea disposal and calls for a reassessment of the whole decision-making process. If, for whatever reason (commercial or political), Shell's decision to abandon deep-sea disposal sets a trend, **what repercussions will this have on the abandonment of future installations in the UK sector**?

There are currently 219 installations in the UK sector of the North Sea (about half of all structures present). Three-quarters of these are relatively straightforward to decommission and were already going to be disposed of on land, but it was intended that about 50 deep-water installations would be assessed in a similar way to the Brent Spar, and the full range of disposal options (described earlier) evaluated.

The 50 deep-water installations include 7-8 with functions similar to the Brent Spar, such as offshore loading units, which would be difficult to bring ashore for disposal, and the Energy Minister has suggested that deep-sea disposal could represent the BPEO for them. In the light of Shell's abandonment of plans for deep-sea disposal of the Brent Spar, some groups argue that all such installations should be disposed of on land, and that the protracted and expensive (preparing Shell's BPEO case cost £2.5M) evaluations of BPEO could be reduced. The UK Offshore Operators Association (UKOOA) report that only 1-2 of these more difficult installations will have to be decommissioned within the next 10 years, so that if alternative facilities for onshore dismantling do not currently exist in the UK, there is time to evaluate the pros and cons of adapting existing platform construction or other sites to allow the UK to compete for contracts in this field, and for carrying out more of the initial dismantling at sea.

The outcome of the Brent Spar debate has however caused many to be concerned that 'holistic' decisions taken as a result of looking at the overall strength of a case to dispose of at sea or on land are reversed by focusing on only one aspect. In particular, some have pointed to the lack of priority assigned to human health and safety considerations in the debate, and argue that they should carry at least as much weight in decision-making as environmental protection - indeed, the Offshore Installations (Safety Case) Regulations (1992) stipulate that operators must demonstrate how the risks involved in decommissioning will be reduced to as low as reasonably practicable (Figure 1).

Regardless of the fate of the limited number of 'special' structures, there would be even greater implications of a more comprehensive land-only policy which ruled out abandonment of the 'stumps' or other partial removal mechanisms for all 50 or so deep-water installations. The industry points out that the costs of decommissioning over the next 10 years under current policies are already estimated at £1,500M, and increases on this will reduce or remove the economic viability of the more marginal North Sea fields. A 'clear seas' philosophy applied to all installations including *in situ* abandonment of pipeline systems could cost £3,000M extra (spread over many years), two thirds of which are borne by the tax-payer under current arrangements.