Proposed exploration drilling, Exmouth Gulf

LASMO Oil (Australia) Ltd

Report and recommendations of the
Environmental Protection Authority

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Summary and recommendations

LASMO Oil (Australia) Ltd has proposed an offshore exploration drilling programme for petroleum within its permit areas EP-342 and TP/9, at the open end of Exmouth Gulf. This proposal seeks environmental approval for the drilling of two wells in 1991, followed by a minimum of three others over the period 1992-94.

The Authority has previously assessed a number of petroleum exploration proposals in the Exmouth region. As a consequence, the Authority's general position on these sorts of proposal may be summarised as follows:

- land-based petroleum exploration proposals can usually be made to be environmentally acceptable;
- land-based petroleum exploration proposals in Marine Parks will be assessed for environmental acceptability on their merits;
- marine-based petroleum exploration proposals in Marine Parks are environmentally unacceptable;
- in environmentally sensitive areas, petroleum exploration proposals need to clearly demonstrate the capacity to cope with environmental impacts, especially possible oil spills in terms of credible events, their likely frequency and contingency planning; and
- outside environmentally sensitive areas exploration proposals normally could proceed, subject to standard environmental protection conditions.

Many areas of the Gulf are regarded as being environmentally sensitive, with several locations having high conservation values. Accordingly the proponent was required to prepare a Consultative Environmental Review (CER) for public review and formal assessment, and undertook to prepare sufficient documentation to enable the assessment of a permit-wide drilling programme.

This is the first assessment of this type. It is designed to provide for a formal assessment procedure to be initiated for the programme, instead of for each separate well. This is expected to lead to savings in time and resources for proponents, involved agencies, the public and the Environmental Protection Authority. In the case of this proposal LASMO has identified two drill targets for initial investigation. However, further drill sites are expected to be selected and under these circumstances the Authority would wish to be assured that the environmental management provisions had been applied in a site-specific manner. The Authority has recommended that an appropriate mechanism for activating this be put in place.

The two locations proposed for drill testing in 1991 are fully developed drill targets for which the precise location is known. The first is proposed at a point 2.5km north-east of the north end of North Muiron Island, while the second lies about the same distance to the south-west of South Muiron Island just outside the north-west boundary of Ningaloo Marine Park. It is proposed to use a jack-up rig for these and subsequent wells if possible, so as to keep clear of the islands.

Keeping clear of the islands is significant in the context of possible future proposals to develop petroleum reserves outlined by exploration drilling. The Environmental Protection Authority wishes to emphasise the environmental significance of the area and advises that it should not be assumed that production facilities on the Muiron Islands or pipelines through Ningaloo Marine Park en route to a mainland facility at the tip of North West Cape would be environmentally acceptable.

The region is subject to strong winds and currents and lies within the cyclone-affected belt of Australia. The shallow waters and intertidal zones support a diverse range of biota which give the area its high conservation, commercial fishing and tourist values.

Concerns raised in public submissions centre around the timing of the proposed drilling, the fate of drill cuttings, domestic wastes and oil spills, and the impacts of each of these on the wildlife and resources of Exmouth Gulf. The ability of an explorer to minimise and manage environmental effects and to respond to cyclone alerts quickly enough (given that cyclones may be very unpredictable) was also questioned.

LASMO has researched the environmental sensitivities of the permit areas and modelled the likely spread of spills of oil from several locations. The company has emphasised that oil from this area and

spilt in this region typically evaporates very quickly, due to the high ambient temperatures and its characteristic lightness or volatility. Thus, if a spill were to reach a shoreline, it would not persist as a heavy dark sludge as do spills in many other parts of the world. Statistics of oil spills indicate that, although small spills are reasonably common, they are relatively easy to control and unlikely to have a significant impact if the appropriate equipment is on hand. Larger spills are a more serious problem but are rare, and none is known to have occurred in the history of drilling offshore from Australia.

Routine discharges from the rig consist of domestic waste water, drill cuttings and drill muds. LASMO has committed to dealing with these wastes in a manner which recognises the environmental sensitivity of the area and minimises the impacts in an acceptable way.

Recommendation 1

The Environmental Protection Authority concludes that the proposal to conduct an offshore exploration drilling programme in Exmouth Gulf, as described in the Consultative Environmental Review is environmentally acceptable in areas outside of Ningaloo Marine Park.

In reaching this conclusion, the Environmental Protection Authority identified the main factors requiring detailed consideration as the effects of routine and accidental discharges arising from the drilling operations upon the environment, and the industries which are dependant on it.

The Environmental Protection Authority considers that these and other issues have been addressed by either environmental management commitments given by the proponent or by the Environmental Protection Authority's recommendations in this report.

Accordingly the Environmental Protection Authority recommends that the proposal could proceed, subject to:

- **the proponent's commitments; and**
- **the Environmental Protection Authority's recommendations in this report.**

The proponent's permit areas overlap the boundary of Ningaloo Marine Park (see Figure 1). The Environmental Protection Authority considers that it would be environmentally unacceptable for the proponent to drill within the marine areas of the Ningaloo Marine Park.

Recommendation 2

The Environmental Protection Authority recommends that there be no drilling permitted within the marine areas of the Ningaloo Marine Park for this or any other proposal.

The Environmental Protection Authority is aware that this proposal is a programme to access several wells and that only two have been accurately located and specified at this stage. Any further wells will need to be forwarded to the Environmental Protection Authority with information on exact location, receiving environment and any proposed environmental management changes arising from proposed timing and discharges of routine domestic and drilling wastes.

Recommendation 3

The Environmental Protection Authority recommends that, at least three weeks prior to the commencement of drilling of wells subsequent to the initial two proposed, each exploration well proposal within this programme be forwarded to the Environmental Protection Authority with additional details of the exact location and its environment, and any proposed site-specific modifications to environmental management provisions, and implements the proposals to the satisfaction of the Environmental Protection Authority.

Recommendation 4

The Environmental Protection Authority recommends that the Muiron Islands, which were proposed for upgrading to a "B" Class reserve for the preservation of flora and fauna in the Environmental Protection Authority's 1975 recommendations in "Conservation Reserves for Western Australia", be upgraded promptly, so as to recognise the high conservation value of these islands.

The proponent has made a commitment to accept responsibility for possible environmental impacts of a potential oil spill and the Environmental Protection Authority endorses this.

Recommendation 5

The Environmental Protection Authority endorses the proponent's commitments to accept responsibility for any adverse environmental impacts, which may occur as a consequence of the proposal proceeding, and recommends that the arrangements for meeting this condition should be to the satisfaction of the Minister for Environment after consultation with the Minister for Mines and the Minister for Fisheries.

Recommendation 6

The Environmental Protection Authority recommends that the proponent forwards plans to use any type of drill rig other than a jack-up platform to the Environmental Protection Authority for further evaluation, and also recommends that the proponent forwards details of future exploration drilling (other than those comprising this programme) or development plans resulting from this exploration drilling proposal to the Environmental Protection Authority for assessment.

The proponent has made a commitment to provide equipment on-site with the capability to contain a $20m^3$ spill which the Environmental Protection Authority regards as satisfactory.

Recommendation 7

The Environmental Protection Authority is aware that the proponent includes in the Oil Spill Contingency Plan, the capability for containment of small oil spillages on or adjacent to the rig and that a suitable boom and skimmer device, together with operators skilled in their deployment, would be installed on or adjacent to the rig prior to the commencement of drilling and remain there permanently until demobilisation of the rig. The Environmental Protection Authority recommends that this approach should be adopted, to the satisfaction of the Environmental Protection Authority, on advice from the Department of Mines.

Recommendation 8

In order to maximise recovery of spilled oil where an environmentally sensitive location is close enough to the rig to be within its zone of influence from an oil spill, the Environmental Protection Authority recommends that refuelling of the rig should only take place when weather conditions meet the criteria determined by the Environmental Protection Authority on advice from the Department of Mines.

Refuelling in conditions where current speeds are less than 0.7 knot, wind speed is below 15 knots and in wave heights of 1m or less would be regarded as satisfactory.

Recommendation 9

The Environmental Protection Authority recommends that in order to minimise the likelihood of failure of the well casing, the proponent should, prior to drilling ahead, pressure test each string of casing to the satisfaction of the Director, Petroleum Division, Department of Mines.

Recommendation 10

The Environmental Protection Authority recommends that, prior to the cementing in of the conductor pipe of the top section of the first well, the proponent successfully trial runs a simulated Oil Spill Contingency Plan up to the point of deployment of resources, to ensure that the plan is workable to the satisfaction of the Environmental Protection Authority. The Environmental Protection Authority also recommends that, while drilling is occurring, further simulated Oil Spill Contingency drills be run at least once a year, or for each change of drilling rig, whichever is sooner, to maintain a high level of preparedness among all involved personnel.

Recommendation 11

The Environmental Protection Authority recommends that the proponent be responsible for decommissioning the rig and the well, and rehabilitating the site and its environs to the satisfaction of the Environmental Protection Authority, on advice from the Department of Mines.

1. Introduction

In May 1990 LASMO Oil (Australia) Ltd. (LASMO) submitted a proposal for drilling within petroleum exploration permit areas EP-342 and TP/9, which are located at the north, or open end of Exmouth Gulf (see Figure 1). LASMO is the manager of a joint venture involving:

- LASMO Oil (Australia) Ltd 33 1/3%
- Pacific Oil and Gas Pty Ltd 26 2/3%
- Hadson Carnarvon Pty Ltd 20%
- Asamera Australia Ltd 20%

The proposal seeks to drill test leads defined by recently acquired seismic data within the permits, (as shown in Figure 1). Two wells are proposed for the first test, followed by a minimum of three wells over the next three years, to be planned upon review of the initial drill results.

The Authority has previously assessed a number of petroleum exploration proposals in the Exmouth region. As a consequence, the Authority's general position on these sorts of proposal may be summarised as follows:

- land-based petroleum exploration proposals can usually be made to be environmentally acceptable;
- land-based petroleum exploration proposals in Marine Parks will be assessed for environmental acceptability on their merits;
- marine-based petroleum exploration proposals in Marine Parks are environmentally unacceptable;
- in environmentally sensitive areas, petroleum exploration proposals need to clearly demonstrate the capacity to cope with environmental impacts, especially possible oil spills in terms of credible events, their likely frequency and contingency planning; and
- outside environmentally sensitive areas exploration proposals normally could proceed, subject to standard environmental protection conditions.

The Environmental Protection Authority determined that a formal assessment at the level of Consultative Environmental Review would be required. At this stage LASMO is unable to specify the locations of all the proposed wells because some of the later wells are dependant on results from the initial drilling. However, the seismic data have indicated a number of leads which could be drill targets, and approval in principle is being sought for the programme. In order to improve the efficiency of the formal assessment process and reduce repetition it has been agreed that, rather than submitting proposals for one well at a time, it would be acceptable to submit a proposal for a programme to address the entire permit area, provided that the CER adequately addressed all the relevant issues and that the site-specific data would be submitted at a later stage, prior to drilling, for further evaluation by the Environmental Protection Authority.

The proponent was asked to define the environmental sensitivity of the areas likely to be within the zone of influence of the proposed drilling; to assess the likelihood and potential impacts of an oil spill; and to demonstrate that routine and credible accidental discharges from the offshore drilling platform could be properly managed at the proposed sites so as to ensure no significant impacts in environmentally sensitive areas.

While this proposal concentrates on exploration, it could lead to a production proposal if payable petroleum reserves are discovered. With regard to production facilities it should be emphasised that the Muiron Islands are very high value reserves for the conservation of flora and fauna and it should not be assumed that production facilities on the Muiron Islands or pipelines routed through Ningaloo Marine Park to a production facility at North West Cape would be environmentally acceptable.

There is a view often put that Australia's heritage of environmental resources should not be subjected to increased risk of damage by petroleum or other resource exploitation whilst our exploitable reserves of petroleum continue to be plentiful and cheap, and used less effectively than would be the case if they were in scarce supply. In this context it is noted that LASMO's permit areas overlap the boundary

of the Ningaloo Marine Park and that government policy is to not permit drilling in marine parks for new applications.

Recommendation 2

The Environmental Protection Authority recommends that there be no drilling permitted within the marine areas of the Ningaloo Marine Park for this or any other proposal.

2. Project description

It is proposed to drill two exploration wells as soon as possible following approval. A minimum of three additional wells would be subsequently drilled within the permit areas.

Information regarding the locations of the first two wells has now been made available to the Environmental Protection Authority in LASMO's response to questions raised in submissions. The first location is approximately as shown as B1 in Figure 1 and lies about 2.5km east of the northern point of North Muiron Island in 19m of water. The second well is proposed for a site approximately 1.8km south of the location A1 in Figure 1. This position is just outside the north-western boundary of the Ningaloo Marine Park.

The Environmental Protection Authority is aware that this proposal is a programme to access several wells and that only two have been accurately located and specified at this stage.

Recommendation 3

The Environmental Protection Authority recommends that, at least three weeks prior to the commencement of drilling of wells subsequent to the initial two proposed, each exploration well proposal within this programme be forwarded to the Environmental Protection Authority with additional details of the exact location and its environment, and any proposed site-specific modifications to environmental management provisions, and implements the proposals to the satisfaction of the Environmental Protection Authority.

LASMO anticipates using a jack-up drill rig for the current programme. This will be useful where drill targets are located adjacent to or underneath islands, as is the case with some of LASMO's selected sites around the Muiron Islands. Rather than transporting a land based rig to the location a deviated well could be drilled from an offshore jack-up rig in most cases, avoiding the penalties in transportation and environmental costs associated with the former. LASMO has indicated that it does not anticipate a need to drill from islands.

Two supply boats would be used to service the rig and the 80 personnel based on board. They would operate from Dampier where there are established facilities. A helicopter operating from Learmonth would be used for crew changes and supplementary provisioning of the rig.

3. Existing environment

The permit areas lie at the open end of Exmouth Gulf. In these shallow waters the winds play an important part in modifying the movement of surface waters, which are primarily driven by semi-diurnal tidal movements. Oil spills, being largely restricted to the top few centimetres of the water column, are subject to the same influences.

The prevailing winds are westerly to south-westerly at most times of the year barring the winter months, when winds off the mainland are most common. In summer diurnal effects act to raise wind speed in the afternoon to about 20-25 knots and to reduce it during the night and early morning. Winter winds from the mainland can also be strong. The company's analysis of the occurrence of cyclones shows

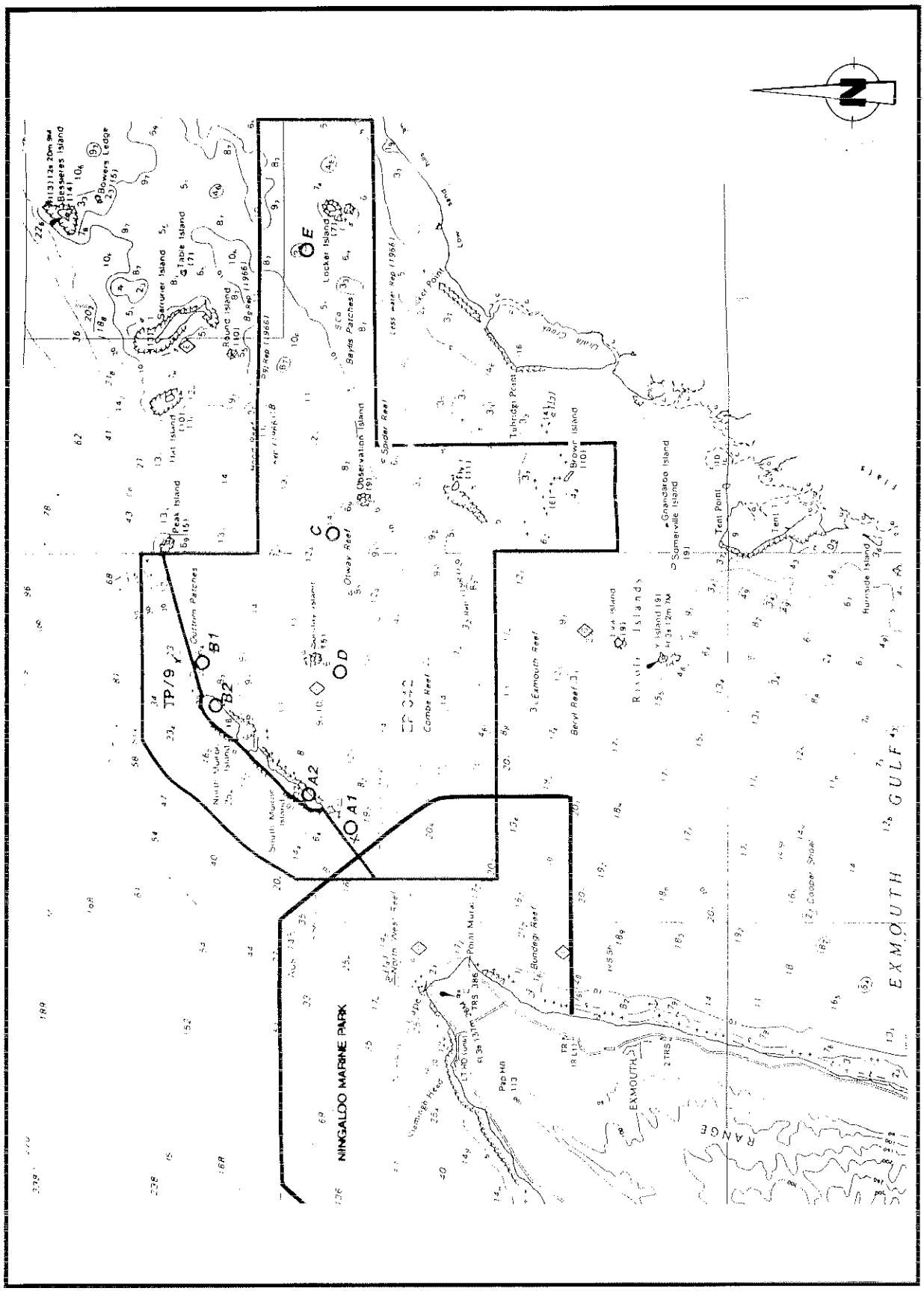

Figure 1: Location of permits and possible drilling sites

that an average of 1.2 cyclones per year occur within 150km of the permit area. These may be accompanied by strong tidal surges and winds from any direction. (It is company practice to close down drilling operations and plug and shut in the well during a cyclone Red Alert. Details of these procedures are given in LASMO's response to submissions in Appendix 2.)

Due to the smaller tidal variation, tidal currents tend to be slower in the Exmouth-Onslow region than elsewhere in the Pilbara. But there are localised strong currents in tidal channels in the vicinity of North West Cape and the Muiron islands in areas proposed for drilling and this has obvious management implications for spills in these areas.

The western side of the permit areas has diverse and sensitive marine and intertidal environments which include turtle, amphipod and bird nesting beaches; intertidal rock platforms and reefs; shallow algal and seagrass meadows which are frequented by dugongs; and coral reefs. The Muiron Islands are the largest and most significant of the islands in the area. While currently vested jointly in the Shire of Exmouth and the National Parks and Nature Conservation Authority (NPNCA) as a "C" Class reserve for the conservation of flora and fauna the Authority believes that their status should be upgraded to reflect the high conservation values of these islands.

Recommendation 4

The Environmental Protection Authority recommends that the Muiron Islands, which were proposed for upgrading to a "B" Class reserve for the preservation of flora and fauna in the Environmental Protection Authority's 1985 recommendations in "Conservation Reserves for Western Australia", be upgraded promptly, so as to recognise the high conservation value of these islands.

The mangrove stands near the south and eastern portions of permit area EP-342 are also considered to be environmentally sensitive and have high conservation values. LASMO's report states that they are "probably the most critical ecological components in the region".

The main activities in the region concentrate on its marine resources. Important recreational and commercial fisheries and tourism-based activities are centred at Exmouth and, to a lesser extent, Onslow. The Exmouth Gulf prawn fishery season begins in late March and continues through until November. The petroleum industry uses Onslow and Exmouth to a limited degree to support offshore bases and drilling activities.

4. Public submissions

A total of ten submissions were received, five from government agencies and five from individuals and industry in the Exmouth area.

The main concerns raised were:

- effects on the environment of drill cuttings and muds;
- effects on the environment of oil spills;
- the results of environmental impacts on the commercial and recreational sectors;
- the need for adequate compensation for these sectors in the event of impacts;
- the timing of proposed drilling and likely conflicts with the fishing industry;
- the effect of unpredictable cyclonic events on securing the rig against leaks.

LASMO's responses to questions raised are included as Appendix 2.

5. Management of environmental impacts

Impacts on the marine environment from drilling activities can arise either from routine or from accidental discharges. Depending on how environmentally sensitive the rig location is and how

activities on the rig are managed, there could be a range of effects varying from insignificant to potentially serious, at least in the short term.

From Table 1 it can be seen that, in the global context, the statistics of oil spills into the marine environment are dominated by the transportation of oil and terrestrial runoff from all sources, which account for 81% of the total in the average year. Table 2 lists all of the major spills (>10,000 barrels) which have occurred up to the time of preparation of these statistics. The Ixtoc No 1 blowout in Mexican waters, the world's largest spill at the time, would have contributed about 12% of the year's total, based on the amounts in Table 1. Whilst there is no intention of trivialising the potential impacts of a major oil spill, the data indicate that large accidental spills from exploration or production facilities are rare events and that there is more threat from coastal shipping movements. This is an area which needs more attention so as to reduce the chances of major impacts and is especially relevant to the development stage of an oil programme. The environmental sensitivity of the Muiron Islands and Ningaloo Marine Park should again be highlighted in this context.

Drilling over the last 30 years within the north-west shelf region has shown that there is a low risk of wells entering abnormally pressured reservoirs in LASMO's permit areas, thus reducing the risk of blowouts. LASMO's research (P 28 of CER) into the incidence of accidental discharges into Australian waters quotes from communication with the Australian Petroleum Exploration Association in 1990 that "there has been no reported significant oil spill requiring clean-up". Whilst this qualified statement gives no indication of how many spills were reported versus the total number, nor of how many were significant, there are no known incidents of environmentally significant spills being reported by industry or others as a result of exploration or production activities. If spills occur far enough from sensitive locations to enable the oil to biodegrade and evaporate before reaching these locations there may be no need to control them or apply dispersants (which are in themselves environmentally damaging chemicals). The north-west shelf area typically contains reserves of light grade crude petroleum, (API gravity from 29 to 48 degrees) which evaporates and biodegrades quickly in the warm waters and high ambient temperatures common to the region leaving, in some cases, little sign of its passing after a few days. Accordingly it generally does not require the use of dispersants, in contrast with heavy and waxy crudes from overseas which can be transported over long distances by wind and tide action because they do not readily break up. Observations of spilt oil from the North West Shelf area indicate that up to 75% would be likely to evaporate within 24 hours.

LASMO has discussed these impacts at length in its CER. The results of modelling simulated spills indicate that the risks of impact of spills to the Ningaloo Reef are very small (Table 6.3 in the CER), and then only after at least 24 hours on the sea, thus allowing for most of the oil to have evaporated or degraded to less toxic components. Similarly, the modelling indicates that the southern part of Exmouth Gulf is not at risk within 48 hours from oil spilled anywhere within the permit area. However, whilst bearing in mind that such spills are rare, the Muirons and other islands with sensitive reef environments would be at significant risk from medium to large uncontrolled spills if they occurred whilst the rig was located at tentatively proposed drill sites A1, B1, C1 and D2.

There are a number of marine-based industries which are potentially at risk from uncontrolled spills. These include the prawn trawling, recreational fishing and tourist industries. The concerns raised by representatives of these sectors have been addressed in the proponent's responses to submissions and are reflected in LASMO's commitments to manage the drilling operations closely, and to be held responsible for any adverse impacts to the commercial fishery and the tourist and recreation industries that may occur as a result of an oil spill. The Environmental Protection Authority commends this approach by the proponent, which is a very important provision to emplace under these circumstances.

Table 1: Input of hydrocarbons into the marine environment (Source: NAS 1985)

Source	Best estimate (million metric tonnes/year)	Percentage (%)
A Natural Sources		
Marine seeps	0.2	6.2
Sediment erosion	0.05	1.5
Total Natural Sources	**0.25**	**7.7**
Offshore Production	**0.05**	**1.5**
B Transportation		
Tanker operations	0.7	21.5
Dry-docking	0.03	0.9
Marine terminals	0.02	0.6
Bilge and fuel oils	0.3	9.2
Tanker accidents	0.4	12.3
Non-tanker accidents	0.02	0.6
Total transportation	**1.47**	**45.2**
C Atmosphere	**0.3**	**9.2**
D Municipal and Industrial Wastes and Run-off		
Municipal wastes	0.7	21.5
Refineries	0.1	3.1
Non-refining industrial wastes	0.2	6.2
Urban run-off	0.12	3.7
River run-off	0.04	1.2
Ocean dumping	0.02	0.6
Total Wastes and Run-off	**1.18**	**36.3**
TOTAL	**3.25**	**100.0**

Conversion: 7.6 barrels (bbl) to the metric tonne

Table 2: Large oil spills from offshore well blowouts

Area	Reported spill (bbl)	Million metric tonnes	Date	Operation underway
Mexico	3,000,000	0.395	1979	Exploratory drilling
Dubai	2,000,000	0.263	1973	Development drilling
Mexico	247,000	0.033	1986	Workover
Nigeria	200,000	0.026	1980	Development drilling
North Sea/Norway	158,000	0.021	1977	Workover
Iran	100,000	0.013	1980	Development drilling
USA Santa Barbara	77,000	0.010	1989	Production
Saudi Arabia	60,000	0.008	1980	Exploratory drilling
Mexico	56,000	0.007	1987	Exploratory drilling
USA S Timbalier 26	53,000	0.007	1970	?
USA Main Pass 41	30,000	0.004	1970	Production
Trinidad	10,000	0.001	1973	Development drilling

Source: Oilspill Preparedness in the Upstream Petroleum Industry: The Canadian Petroleum Association and The Independent Petroleum Association of Canada, 1989

Recommendation 5

The Environmental Protection Authority endorses the proponent's commitments to accept responsibility for any adverse environmental impacts, which may occur as a consequence of the proposal proceeding, and recommends that the arrangements for meeting this condition should be to the satisfaction of the Minister for Environment after consultation with the Minister for Mines and the Minister for Fisheries.

The oyster collecting industry which is based in Gales Bay at the southern end of Exmouth Gulf is, according to the dispersion studies commissioned for the proponent, at least 48 hours away from an oil spill emanating from the permit area. The likelihood of there being impacts to the southern part of the gulf from spilled oil from the drilling programme is considered to be low enough to be acceptable.

To address potential conflicts with fishing operations arising from the location of the rig and the timing of its operations LASMO proposes to liaise with representatives of the fishing industry.

So as not to disturb seabird colonies helicopters would be instructed to avoid overflying islands. In addition all crew members would be educated to the sensitive nature of the area, and of their individual responsibilities for its protection.

A variable that is not considered here is the type of drill rig to be used. LASMO has indicated that its preference is for a jack-up style rig (see Section 2). Recognising the likely environmental impacts associated with the placement of a land-based rig on any of the islands in the permit areas the Environmental Protection Authority is also in favour of the use of the offshore rig, and bases its assessment on this option.

Recommendation 6

The Environmental Protection Authority recommends that the proponent forwards plans to use any type of drill rig other than a jack-up platform to the Environmental Protection Authority for further evaluation, and also recommends that the proponent forwards details of future exploration drilling (other than those comprising this programme) or development plans resulting from this exploration drilling proposal to the Environmental Protection Authority for assessment.

5.1 Routine discharges

These can be grouped into domestic and drilling-associated wastes. Treated sewage, "grey water" and galley wastes are pulverised and disinfected prior to discharge into the sea. No significant environmental impacts are expected due to the biodegradability of the product, short period of drilling activities and large dilution factor, unless the rig is to be set up in a basin with restricted natural circulation.

Drilling generates rock cuttings with residual amounts of drilling muds adhering to the chips. Depending on the local environment and the type of mud these wastes can have a significant impact and may need to be managed appropriately. LASMO and their consultants have recognised these requirements and made acceptable proposals to ensure that environmentally sensitive locations would not be significantly impacted. Briefly these include:

- routinely using low toxicity, water-based drilling muds;
- routinely washing the drill cuttings with sea water to recover drilling mud prior to their discharge on the seabed;
- conducting a pre-drilling site assessment in consultation with the Environmental Protection Authority to identify sea floor communities and prevailing winds and currents. On the basis of this assessment LASMO would manage the disposal of solids in a site-appropriate manner including:
- for drilling locations near coral reefs adjacent to the Muiron Islands, loading solids into skips for transportation and disposal in deep water at least 5km from the Muiron Islands and/or Ningaloo Marine Park;
- for clear water drill sites elsewhere solids and excess muds would be discharged via a pipeline return to the sea floor (to minimise associated turbidity), when tidal and wind currents are strong and moving away from any adjacent sensitive areas.

The Environmental Protection Authority commends these commitments, which have not been volunteered before, as a commonsense approach to a common disposal problem.

5.2 Accidental discharges

Accidental oil spills can occur, in order of increasing size, from the rig refuelling operation, from a production test, or as a result of a blowout of crude oil from the well. LASMO discusses each of these scenarios in its CER, together with commitments listed in Appendix 1 of this assessment to ensure that the risk of these events is minimised and that spills will be managed appropriately if they occur.

The most common type of spill is a minor spill of between $1m^3$ and $20m^3$ arising from refuelling or from a short term failure of the blowout preventers. Refuelling of the rig usually occurs once every 10 days on average. The proponent has committed to containing and collecting spills of this order with a Vikoma Seapak boom and Seaskimmer. The Authority notes and endorses LASMO's commitments to place the Vikoma boom and skimmer with the capacity to contain spills up to $20m^3$ at the drilling location, ready for immediate deployment at all times during drilling.

Recommendation 7

The Environmental Protection Authority is aware that the proponent includes in the Oil Spill Contingency Plan, the capability for containment of small oil spillages on or adjacent to the rig and that a suitable boom and skimmer device, together with operators skilled in their deployment, would be installed on or adjacent to the rig prior to the commencement of drilling and remain there permanently until demobilisation of the rig. The Environmental Protection Authority recommends that this approach should be adopted, to the satisfaction of the Environmental Protection Authority.

However, for a reasonable chance of a successful recovery of oil spilt, weather conditions need to be near optimal (current speed <0.7 knot, wind speed <15 knots and wave height <1m). As waves and

currents become progressively larger, increasing amounts of oil would be lost beneath the boom so that the attendant oil recovery unit would collect progressively less of the spill. A mitigating factor is that, under more severe weather conditions the oil evaporates far more quickly. The doubling of wind velocity, up to the onset of whitecapping causes the rate of evaporation to increase by a factor of 1.7 and with the onset of extensive whitecapping the rate increases by a factor of 5 to 10 (Sect 6.3.3 of the CER). Recognising that the boom and skimmer have only limited application the Environmental Protection Authority makes the following recommendation for refuelling in environmentally sensitive locations:

Recommendation 8

In order to maximise recovery of spilled oil where an environmentally sensitive location is close enough to the rig to be within its zone of influence from an oil spill, the Environmental Protection Authority recommends that refuelling of the rig should only take place when weather conditions meet the criteria determined by the Environmental Protection Authority on advice from the Department of Mines.

Refuelling in conditions where current speeds are less than 0.7 knot, wind speed is below 15 knots and in wave heights of 1m or less would be regarded as satisfactory.

Partially controlled or uncontrolled blowouts are less common (see Table 2) but can result in much greater loss of oil. Little of this flow can be recovered in most cases and thus, in confined areas within Exmouth Gulf, the impacts of such an accident are likely to be extensive, although not necessarily long-term. Whilst there has never been such a spill documented in Australia and there is a low risk of abnormally pressured reservoirs in LASMO's permit areas it is clearly vital that the best policy is minimisation of the risks and avoidance of the events leading to an oil spill, together with a well rehearsed Oil Spill Contingency Plan to deal with accidents.

Recommendation 9

The Environmental Protection Authority recommends that in order to minimise the likelihood of failure of the well casing, the proponent should, prior to drilling ahead, pressure test each string of casing to the satisfaction of the Director, Petroleum Division, Department of Mines.

Recommendation 10

The Environmental Protection Authority recommends that, prior to the cementing in of the conductor pipe of the top section of the first well, the proponent successfully trial runs a simulated Oil Spill Contingency Plan up to the point of deployment of resources, to ensure that the plan is workable to the satisfaction of the Environmental Protection Authority. The Environmental Protection Authority also recommends that, while drilling is occurring, further simulated Oil Spill Contingency drills be run at least once a year, or for each change of drilling rig, whichever is sooner, to maintain a high level of preparedness among all involved personnel.

Recommendation 11

The Environmental Protection Authority recommends that the proponent be responsible for decommissioning the rig and the well, and rehabilitating the site and its environs to the satisfaction of the Environmental Protection Authority, on advice from the Department of Mines.

6. Discussion and conclusion

This drilling proposal has raised public concerns for the environment based on widely held perceptions about the damage that can arise from oil spills. It is becoming apparent, as more is learned

about the characteristics of north-west shelf crude oil and its reaction with the local environment, that many previously held assumptions are not accurate. This is particularly true with respect to the fate of oil spilled in the region. The "lightness" of the crude, allied with the generally high ambient temperatures and brisk winds, combine to minimise the risk of a spill impacting on sensitive environments. Badly oiled beaches and birds which have resulted from tanker spills of heavy oils elsewhere around the world do not accurately represent the most likely impacts of a spill of local crude oil in the north-west shelf area. Coupled with this is the fact that the great majority of oil spilled into the oceans comes from sources other than drilling or production facilities. The risk of a medium to large spill occurring is low in Australian waters, and small spills can be managed much more effectively.

LASMO has answered the questions raised in submissions and made commitments which go beyond those previously undertaken. The Environmental Protection Authority commends this proactive approach and considers that the proposal, subject to the commitments given by LASMO and the Environmental Protection Authority's recommendations in this report, could be implemented in an environmentally acceptable manner.

Recommendation 1

The Environmental Protection Authority concludes that the proposal to conduct an offshore exploration drilling programme in Exmouth Gulf, as described in the Consultative Environmental Review is environmentally acceptable in areas outside of Ningaloo Marine Park.

In reaching this conclusion, the Environmental Protection Authority identified the main factors requiring detailed consideration as the effects of routine and accidental discharges arising from the drilling operations upon the environment, and the industries which are dependant on it.

The Environmental Protection Authority considers that these and other issues have been addressed by either environmental management commitments given by the proponent or by the Environmental Protection Authority's recommendations in this report.

Accordingly the Environmental Protection Authority recommends that the proposal could proceed, subject to:

- **the proponent's commitments; and**
- **the Environmental Protection Authority's recommendations in this report.**

No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent should take place until the Minister has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister should be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

The Authority notes that during the detailed implementation of proposals, it is often necessary or desirable to make minor and non-substantial changes to the design and specification which have been examined as part of the Authority's assessment. The Authority believes that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

The Authority believes that any approval for the proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the Authority.

Appendix 1

Proponent's commitments

Proponent's commitments

Summary of commitments

LASMO are committed under the terms of the Exploration Permit to comply with all legislative and regulatory requirements pertaining to the proposed drilling program, and to all directions given by the Minister for Minerals and Energy. Further, a commitment has been given to adopt industry and government standards and guidelines for safe exploration drilling practice.

LASMO also commit themselves to comply with management proposals described in this CER. Specifically, these include the following:

A. Operational management

1. Mud engineering will be managed throughout the drilling program so that toxicity values never exceed the USEPA standards approved for offshore use.
2. For drilling operations within close proximity to coral reefs near the Muiron Islands, and with the possible temporary exception when precluded by inclement weather, all drill cuttings and occasional excess drilling fluid requiring disposal from the rig will be transported for disposal in deep water at least 5km offshore from the Muiron Islands and/or Ningaloo Marine Park.
3. *For drilling locations where direct drilling solids disposal is proposed, and for drilling locations near coral reefs when required by inclement weather, excess drilling muds will be discharged when tidal and wind currents are strong and moving away from areas of coral reef that may be near the drilling location.*
4. Sewage and wastes from the galley, ablutions and laundry will be comminuted and disinfected through a sewage treatment plant prior to discharge.
5. Solid waste materials will either be burnt at the rig or returned to shorebase for appropriate disposal at a refuse site approved by the Local Government Authority.
6. Drainage from areas of the rig where oil is used or stored will be contained on the rig, and subsequently transported ashore for recycling or disposal in a manner approved by the Environmental Protection Authority.
7. Deck drainage from elsewhere on the rig will be ducted to an oil-water separator prior to discharge, and any oily waste will be transported ashore for recycling or disposal in a manner approved by the Environmental Protection Authority.
8. Helicopter pilots will be instructed not to overfly islands.
9. Helicopter and workboats will be prohibited from landing on any of the islands in the region without written permission from the Drilling Superintendent.
10. Supply vessels will be contractually obliged to comply with all State and Commonwealth legislation for the control of pollution at sea.
11. Once drilling locations and timing have been identified, LASMO will liaise with the fishing industry to resolve any potential conflict with their operations, to the satisfaction of the Minister for the Environment.

B. Oil spill prevention

1. LASMO will implement oil spill prevention measures documented in Section 7.3 of this CER, to the satisfaction of the Department of Mines

C. Oil spill response

1. A Vikoma oil spill containment boom and skimmer, together with operators skilled in their use, will be located at the drilling location and ready for immediate deployment at all times during drilling.
2. LASMO will comply with the guidelines provided in the Oil Spill Contingency Plan.

3. Prior to drilling, LASMO will undertake to accept responsibility for any adverse environmental impacts which may occur as a consequence of an oil spill resulting from their operations, to the satisfaction of the Minister for the Environment.

D. Environmental assessment

1. Prior to drilling within the identified Leads A, B and the north-western corner of Lead D, LASMO will undertake a survey of the proposed drilling location to the satisfaction of the Environmental Protection Authority, and will submit a brief report describing the survey results to the Environmental Protection Authority.
2. Following completion of the initial two wells, LASMO will undertake an environmental assessment of the drilling locations and report upon the results, to the satisfaction of the Environmental Protection Authority and the Department of Mines.

Appendix 2

Summary of submissions and proponent's responses

Summary of submissions and proponent's responses

1. Submission: Lack of information on drill sites.

Response: The CER was prepared to assist the Environmental Protection Authority's assessment of the proposed exploration program, and addressed possible exploration anywhere within the permit areas. This was in accordance with the Environmental Protection Authority's specific request for submission of the proposal for the total exploration program rather than on a well-by-well basis.

At the time of preparing the CER, the selection of specific locations for the initial two wells required further interpretation of geophysical data. This process is ongoing, however locations that are presently mature or close to mature are as follows:

Lead	Water depth	East/North	Latitude/Longitude
A	20m	219031	21°44'40"
		7592058	114°17'01"
B	19m	234082	21°36'26"
		7608438	114°25'53"
D	11m	230965	21°43°57"
		7594495	114°23'56"

These locations are approximately equivalent to locations A1, B1 and D shown in Figure 1.3 of the CER.

Two of these locations are proposed to be drilled prior to May 1991. LASMO will notify the Environmental Protection Authority, Department of Conservation and Land Management and the Department of Fisheries of the final locations selected for drilling as soon as they are determined.

2. Submission: Drilling on the Muiron Islands is unacceptable

Response: As discussed in Section 3.0 of the CER if a preferred prospect is identified beneath the Muiron Islands, then providing well depth degree of angle are obtainable, preference would be given to drilling a deviated well from a rig that is located offshore. Drilling on the Muiron Islands is not proposed, and therefore is not addressed by the CER.

3. Submission: Thevenard and Serrurier Island are "C" class reserves.

Response: This is acknowledged. Both of these islands are outside of the permit area.

4. Submission: Representatives of LASMO visiting island nature reserves need to be aware of Section 16 of the Wildlife Conservation Regulations, regarding the "taking" of fauna.

Response: Acknowledged. There will be no landings on any of the islands in the region.

5. Submission; Written permission should be sought from CALM prior to erection of any temporary structures on island nature reserves.

Response: Acknowledged. The requirement is not anticipated.

6. Submission: Helicopter landings on islands should have the prior approval of CALM and/or the Exmouth Shire Council.

Response: Acknowledged. Such landings will be expressly prohibited by LASMO, except in an emergency where a threat to human life exists.

7. Submission: Exploration drilling should be scheduled away from the cyclone season.

Response: As described in Section 4.6 of the CER, cyclones cause expensive delays to drilling but are not a threat to well control. Procedures setting out appropriate response to cyclones, gales and storms are prescribed in the Company's Emergency Response and Safety Manual. These procedures accord with the requirements of the Department of Mines.

During the cyclone season, LASMO's Perth Office and the rig will be advised of cyclonic developments on a 24 hour basis via the Cyclone Watch Centre in Perth. Cyclone "Alert" procedures are initiated when cyclonic activity approaches within 1,300 km or approximately six days travelling distance from the drilling location.

The cyclone status is upgraded to "Red Alert" when the cyclone approaches within 650km or three days estimated travelling distance from the drilling location. It is LASMO's firm intention not to take unnecessary risks regarding unfavourable or deteriorating weather, and when a cyclone reaches the red alert stage, the well and drilling unit will be secured.

This involves suspending drilling operations, hanging-off the drill pipe, removing and securing the divertor, temporarily plugging the well, closing the BOP and skidding the drilling unit away from the well and securing it in place. This secures the well so that any risk of fluids escape (assuming a hydrocarbon bearing zone had been previously penetrated) is effectively precluded.

It is the objective of the cyclone procedures that all cyclone preparation should be concluded and personnel evacuated 24 hours before the cyclone is estimated to hit. For rapidly moving cyclones where little (24 hours) warning is given, securing the well and evacuation of personnel can be achieved within 12 hours.

Upon recommencement of operations, procedures require that any hydrocarbons entrained in the drilling fluid that may have migrated to below the temporary plug (assuming a hydrocarbon bearing zone had been previously penetrated) must be circulated out under controlled conditions prior to normal operations recommencing.

One submission expressed concern about the adequacy of weather forecasting and the possibility of insufficient time to prepare for a major event. LASMO has joined the Tropical Cyclone Industrial Liaison Committee. This Committee includes, among others, most of the offshore operators on the North West Shelf and offers:

- regular meetings and information sharing;
- special daily advices during the cyclone season;
- confidential tailored cyclone warnings to members from the Bureau of Meteorology;
- personal telephone consultation;
- industry early warning weather stations, such as N Rankin platform, Airlie, Varanus and Barrow Islands north-east of our location.

The Committee provides a vehicle for regular liaison between the Company and the Bureau of Meteorology. The Bureau has assured LASMO that they have excellent cyclone systems in place, and that their performance measures up to world standards. The Severe Weather Section was created in 1987, and subsequent research has successfully identified the characteristics of cyclones that accelerate quickly towards the west coast of WA. This has resulted in a methodology to provide timely warnings of such events, as demonstrated by cyclone Ned in April 1989 and cyclone Vincent in March 1990.

In summary, LASMO have formulated extensive cyclone response procedures in an effort to minimise the effects of cyclones on drilling operations. The Bureau of Meteorology is able to provide timely and accurate warning of impending cyclones, following which the well is secured and the crew is evacuated. As a result, drilling during the cyclones season involves no additional risk of an oil spill.

8. Submission: Drilling should not occur during the prawn fishing season (April to November 15).

Response: The 500m radius exclusion zone surrounding drilling operations is only a small area. LASMO will liaise with the fishing industry prior to the commencement of drilling to minimise any potential conflict with their operations (CER Section 6.2).

Exploratory drilling causes negligible adverse impact to the marine environment and would not effect prawn, fish or pearl oyster stocks (Section 6.2).

As discussed in Section 6.3.5 and 6.3.6 of the CER, the likelihood of an oil spill significantly affecting fisheries is extremely remote. LASMO will undertake to accept responsibility for legal liabilities we may incur from any adverse impact on fisheries proven to have resulted from our operations.

9. Submission: Drilling should be postponed to after late Autumn to minimise the risk of an oil spill impacting pearl oyster stocks.

Response: The risk of an oil spill from exploratory drilling is remote. Comprehensive oil spill trajectory modelling undertaken by LASMO shows that the risk of spilled oil being transported to oyster leases in the southern part of Exmouth Gulf is also very low. Further, LASMO will undertake to accept responsibility for legal liabilities we may incur as a result of any adverse impact on the pearl oyster industry proven to have resulted from our operations.

10. Submission. There is very little information available regarding the impacts on nesting turtles from oil and gas exploration and development activity. This aspect requires further research if LASMO choose to drill near the Muiron Islands or near Serrurier Island.

Response: Routine drilling operations should not affect nesting turtles. The proposed drilling operations are offshore, and no island landings of vessels or helicopter crews will be permitted (except in emergencies).

The CER acknowledges that turtle nesting could be significantly affected if spilled oil was to impact sand beaches. The nests are located in the supratidal zone so would not be directly affected, however, access and egress across oiled sand may reduce breeding success.

The risk of a significant oil spillage during exploration drilling is very low (CER Section 4.5.3). If an oil spill does occur, the Oil Spill Contingency Plan highlights the significance of the Muiron Islands and Serrurier Island for turtle nesting, and recommends that priority be given to protecting turtle breeding sites. If turtle breeding beaches do become contaminated by oil, LASMO will implement clean-up procedures in consultation with CALM and Environmental Protection Authority (CER Section 7.5). A number of alternative clean-up strategies that do not involve heavy machinery are proposed in the CER (Section 7.5), and final determination of appropriate measures would be made on the basis of on-site assessment in consultation with the regulatory authorities.

It is acknowledged that there is little information describing the ecology of turtle species using the Rowley Shelf. However, the suggestion that LASMO should undertake further research to remedy this shortfall is considered to be unreasonable given the following:

- The only appreciable risk of impact to turtle nesting is due to the risk of an oil spill, which is very small.
- This issue is not unique to EP-342 and TP/9, as turtles nest in many areas throughout the North West Shelf region. Many developments have taken place through the region that would involve a greater risk to turtles.

Should oil be found within close proximity to turtle breeding beaches on the Muiron Islands, then there is merit in the suggestion that additional research should be undertaken. However, such research should be conducted not by LASMO alone, but on a collaborative basis between the State and the oil production industry, since both groups would benefit from the information obtained.

11. Submission: LASMO should commit to clean any oil contamination of turtle nesting beaches during the nesting season using rakes, with oil debris disposed of appropriately.

Response: LASMO's commitment to accepting responsibility for any adverse environmental impacts that may occur as a consequence of an oil spill (Commitment C3, Section 9.0) is acknowledged to include this commitment. This aspect is specifically addressed in the CER Section 7.5. Actual clean-up methods would be prescribed following a site inspection of oiled beaches in consultation with CALM and Environmental Protection Authority.

12. Submission: The statement in the CER concerning LASMO's acceptance of responsibility for adverse environmental impacts should be more precise.

Response: Refer Commitment C3, Section 9.0. LASMO's specific responsibilities and insurance requirements will be defined prior to the commencement of drilling, to the satisfaction of the Minister for the Environment

13. Submission: Effectiveness of containment booms in rough seas is questioned.

Response: It is acknowledged in the CER that sea-state and current conditions at the time of an oil spill may preclude the effective operation of containment booms and recovery skimmers. Booms are impractical in fresh or strong winds with waves more than about 1.5 m high or in currents exceeding 0.7 knots (0.35 m/s). In currents above this, oil is carried under the boom by the head wave created on the upstream side of the boom regardless of the boom's depth. If conditions are rough, large quantities of water may be included within the recovered liquid and immediate storage and separation problems exist. The wave action may also prevent the containment of the oil within the boom.

Despite these shortcomings, it is universally agreed that the best method of dealing with oil spills - if weather conditions permit - is to contain the oil with booms and recover it using skimmers. To control an oil spill effectively, the rapid deployment of a boom is essential to limit spreading and to concentrate the oil so that skimmers can operate with maximum efficiency. Accordingly, LASMO propose to locate a boom and skimmer at the drilling location, ready for immediate use if weather conditions permit.

In the event that weather conditions do not permit effective use of the boom and skimmer, the CER acknowledges that there is little that can be done except to monitor the trajectory of the oil. The boom and skimmer would be redeployed to areas in the lee of islands or reefs if appropriate. The use of dispersants would be considered if the oil threatened to impact the extensive mangals on the mainland coast, although only upon advice from the Environmental Protection Authority and the State Combat Committee.

It is also pointed out that if sea state conditions are too severe for effective operation of a containment boom, evaporation of oil from the sea surface would be substantially greater than was assumed in the CER. As discussed in Section 6.3.3 of the CER, the doubling of wind speed up to the onset of white capping at about 35km/h has been measured to cause a I.7-fold increase in evaporation rate. The onset of white capping leads to a stepwise increase in evaporation rate,by a factor of 5 to 10.

14. Submission: Ability to transport and deploy "back-up" equipment from other locations in adverse weather is questioned.

Supply vessels that will service the rig will be ocean going craft that are capable of operating in heavy weather conditions. Extreme weather conditions that may effect their operations would also cause the cessation of drilling and the implementation of storm or cyclone emergency response precautions. As discussed in the CER Section 4.6 and reiterated in response to Submission 7 above, this does not involve any threat to well control and the risk of an oil spill at this time is virtually zero.

It is acknowledged that helicopter operations may be affected during heavy weather conditions. This may reduce the effectiveness of proposed surveillance of an oil spill, which would have to be achieved using boats or fixed wing aircraft

The time requirements for transporting additional oil spill equipment and dispersants to site that are quoted in the oil Spill Contingency Plan (Tables 4 and 5) are described for operational consideration and are indicative only. Obviously, additional time may be taken in adverse circumstances, and this would need to be taken into account in operational management of the contingency plan.

15. Submission: Additional oil spill contingency equipment should be located at Exmouth.

Response: A containment boom and skimmer, together with 1200L of dispersants, will be located at the drilling location. This will allow immediate response to an oil spill, with a capability to contain and recover small spillages ($20m^3$) and to handle large spills additional equipment can be brought in to assist. No significant advantage would be gained by locating additional equipment at Exmouth, where marine loading facilities are deficient.

16. Submission: Concern regarding adequacy of oil spill contingency planning.

Response: LASMO acknowledge the environmental sensitivity of the permit area. We have accorded very high priority to preparing a comprehensive and detailed oil spill contingency plan, including the proposed siting of a boom and skimmer at the drilling location (we are not aware of any previous exploration program in Western Australian waters that have taken this precaution).

In addition, LASMO are agreeable to undertaking a simulated oil spill exercise during the initial drilling program to test and, if appropriate, to refine oil spill capabilities.

17. Submission: There should be some indication of the frequency of "occasional" discharge of cuttings and drilling mud at the drilling location.

Response: If the pre-drilling surveys show areas of coral reef near the proposed drilling locations that may be sensitive to turbidity associated with solids disposal, the disposal of drill cuttings and excess muds at the drilling locations will be avoided whenever practicable (CER Sections 3.0 and 4.4). Temporary discharge from the rig may occasionally be required when inclement weather precludes skip transfer to a work boat for offshore disposal and the skips on the rig have been filled. The alternative to allowing this exception, shut down of drilling with consequent loss of two days rig time (one day shut down and a second day reconditioning the hole to allow drilling to recommence, if possible) would cost in the order of $200,000. The environmental implications of occasional direct disposal from the rig are negligible (CER Section 6.1) and can not justify a requirement to shut down drilling operations.

Prolonged inclement weather requiring direct discharge of solids to allow continued drilling is unlikely. It is anticipated that the rig could accommodate at least $80m^3$ of drilling solids, which would permit several days of solids storage except during drilling of the 17.5 inch hole. Reasonable expectations are that prolonged rough seas during the initial drilling may occur, at most, for two days.

LASMO reasserts that neither the intended drilling fluids nor the drill cuttings will have any toxicity at concentrations that will occur in the receiving environment. Two days' direct discharge would involve, at most, $30m^3$ of mud and $82m^3$ of drill cuttings. Dilution during periods of rough seas would be very high, and there would be no significant environmental impact from the exposure levels that would result. Corals within Exmouth Gulf are able to withstand short term turbidity, which would be appreciably less than the turbidity caused by the influence of cyclones along this coastline.

To our knowledge, LASMO will be the first operator within the North West Shelf area to commit to routinely transporting drilling solids offshore for disposal. This commitment to environmental management will be adhered to whenever practicable.

18. Submission: The environmental descriptions of the exploration areas are inadequate and reference to literature about natural history was selective.

Response: The objective of the CER's description of the existing environment (Section 5.0) was to provide "a brief description of the broader physical, biological and environment and coastal processes", with specific reference to the systems that "are potentially at risk from or likely to be

impacted by activities associated with the proposal". The description of the biological environment that is provided in the CER identifies and briefly describes the major biotic assemblages and groups likely to be encountered within and near to the permit areas. Large quantities of additional detailed data would not have greatly improved the accuracy of the assessment of potential effects of the project because of difficulties in predicting impact conditions and the organisms response to those conditions.

Reference to literature about natural history was not intended to be comprehensive, however LASMO's environmental management consultants strongly dispute any implication that there was any bias in the selection of referenced literature. The CER attempted to provide an objective and even-handed approach, consistent with the respected professional reputation of the consultants.

19. Submission: The design of pre- and post-drilling surveys should be specified, and should be of sufficient detail to have the ability to detect a 5-10% change in the environment with 95% confidence.

Response: LASMO will undertake pre- and posting surveys of the proposed drilling locations (Section 7.6, Section 9.0). The surveys will be designed in consultation with the Environmental Protection Authority and the results will be described in a brief report to the Environmental Protection Authority and the Department of Mines.

The proposed surveys will include appropriate replication and controls to enable statistical comparison of pre- and post-drilling condition for assessment of possible drilling impacts. Previous studies undertaken in Ningaloo Marine Park and elsewhere along the Pilbara coast have documented very high temporal and spatial variability in ecological parameters due to natural factors, and these may mask possible small scale alterations due to drilling activities. Given the relatively small area of effect that is anticipated from exploration drilling (CER Section 6.1), and with regard to the large scale natural variation that can occur due to cyclones, coral bleaching, Drupella infestation etc, it is meaningless to prescribe specific detection limits for the proposed monitoring surveys.

The proposed monitoring study will be based on paired sampling techniques to compare the pre- and post-drilling condition of known turbidity-sensitive species that are located at the monitoring sites and representative control sites. Species selection, parameters measured and replication requirements will be defined in consultation with the Marine Impacts Branch of the Environmental Protection Authority.

20. Submission: The CER generally equates Halophila seagrass stands with all seagrass communities. Thalassia species, which comprise a major green turtle food resource, and Cymodocea species, both of which are present on the reefs etc in the Exmouth Gulf region, have practically zero resilience to disturbance.

Response: It is likely that Thalassia and Cymodocea seagrasses occur within mixed algae-seagrass communities on some of the reefs near the Muiron Islands and elsewhere in the exploration permit area, however extensive beds of Thalassia sp. of Cymodocea sp. were not observed during our consultant's surveys. The CER acknowledges (Section 6.3.5) that seagrass meadows and macroalgal beds may be significantly affected by an oil spill. Thalassia species and Cymodocea species are known to be less resilient to disturbance than Halophila and Halodle species and, if significantly affected by an oil spill, may only recover in the long term.

However it should also be noted that, because of the tendency for oil to float, there would be little likelihood that bottom dwelling plants would be significantly affected by an oil spill on open water. Only a worst case scenario would involve a risk that loss of seagrass communities may cause an appreciable reduction of food availability for turtles or dugongs. The probability of such a worst case scenario is so low as to be virtually impossible.

21. Submission: Baseline transect surveys described in Appendix B to the CER are inadequate.

Response: Two permanent transects were established and surveyed during May, 1990 to provide quantitative data describing the baseline condition of representative shallow coral habitats near the

Muiron Islands at that time. These transects will be resurveyed prior to drilling, and will provide two data points of the baseline condition at the specific locations for possible comparative assessment in the unlikely event that an oil spillage affects this coast. The opportunity for paired sample analysis of the data from these permanent transects will enable statistically powerful comparisons. Surveys elsewhere will rely upon comparisons with "unaffected" control sites, which may or may not include the surveyed transects.

It was never intended that the two transects surveyed would be, in themselves, sufficient as a baseline. The baseline will be established by the proposed pre-drilling surveys, which will be designed and conducted following final determination of the proposed drilling locations (refer Submission 9). However the two transects that were established and surveyed in May 1990 will provide an important supplementary reference for analysis of the proposed survey results.

22. Submission: Any material to be disposed by burning should be appropriately incinerated.

Response: This is proposed.

23. Submission: Concern regarding discharge of 80m^3/d of domestic wastes in shallow waters adjacent to the Muiron Islands.

Response: As described in Section 4.4.3 of the CER, sewage and wastes from the galley, ablutions and laundry will be comminuted and disinfected through a sewage treatment plant prior to discharge. Based on an average wastewater generation of 250L/person/day for 60 personnel on the rig, it is anticipated that approximately 15m^3/day of domestic wastewater will require disposal, rather than the 80m^3/day that was stated in the CER.

If it is conservatively assumed that water currents past the rig are only 0.1m/s, this volume of wastewaters would be diluted 14,400-fold following mixing through a 5m x 5m cross sectional area of the water column. This large dilution factor, together with the innocuous nature of domestic wastewaters, do not support environmental concern.