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ISBN. 0 7309 8036 7
ISSN. 1030 - 0120
Assessment No 1040

Summary

Apache Northwest Pty Ltd (the proponent) proposes to develop the Wonnich gas field situated some 8 km south west of the Montebello Islands. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the environment on the environmental factors, conditions and procedures relevant to the proposal.

In the EPA's opinion, giving appropriate consideration to the information in this report and submissions referenced in Appendix 2, the following are the environmental factors relevant to the proposal:

- sea floor
- produced formation water
- condensate and diesel (from accidents)
- coral reefs
- island shores
- mangroves
- dugongs and turtles
- seabirds

The EPA has concluded that, with appropriate management, the EPA's environmental objectives can either be met or are unlikely to be compromised.

In the EPA's opinion, if the proposal is implemented, it should be subject to conditions and procedures as summarised below.

Conditions

(a) the proponent's environmental management commitments as set out in the CER, and as subsequently modified during the assessment process, to be made legally binding.

(b) before construction commences, the proponent shall carry out detailed surveys of the seabed to determine suitable locations for the monopod and pipeline, to the requirements of the Minister for the Environment, on advice of the EPA, in consultation with the DEP, DME and CALM;

(c) the proponent to put in place legally-binding contract requirements with the drilling and pipeline contractors, and with the support vessel operators, to achieve environmental best practice (to be agreed), to the requirements of the EPA on advice of the DEP and the DME.

(d) in order to manage the relevant environmental factors and EPA objectives contained in this bulletin, and subsequent environmental conditions and procedures authorised by the Minister for the Environment, the proponent is required to prepare, prior to implementation of the proposal, an environmental management system, including an environmental management program, in accordance with recognised environmental management principles, such as those in Australian Standards AS/NZS ISO 14000 series.

(e) the proponent to prepare a decommissioning plan at least two years prior to decommissioning, to the requirements of the EPA, on advice of the DEP, DME and CALM.

Procedures

The proposed deep injection well (for disposal of produced formation water) will require separate approval under the Works Approval provisions of the Environmental Protection Act.

Under the provisions of the *Petroleum (Submerged Lands) Act* administered by the Department of Minerals and Energy, the proponent will be required to prepare an annex to the existing oil spill contingency plan. This will detail the contingency measures applicable to a spill of condensate. The annex will be prepared to the requirements of the Department of Minerals and Energy on advice of the State Committee for Combating Marine Oil Pollution and the Department of Environmental Protection.

Other advice

<u>EPA policy on offshore petroleum drilling</u>

The EPA's policy on petroleum drilling near coral reefs and other environmentally sensitive areas is at present being revised in light of new information.

EPA Bulletin 679 'Protecting the marine environment - a guide for the petroleum industry' was released as a public discussion paper in 1993 (EPA, 1993). The main purpose of Bulletin 679 was to provide guidance on levels of environmental assessment for offshore petroleum proposals.

A number of submissions were received from the industry and from conservation groups in response to Bulletin 679. Industry's main concern centred on the issue of exploration in marine parks and reserves and the statement in the Bulletin that there would be a presumption against approval in these areas. Conservation groups expressed opposition to all petroleum drilling in marine reserves or any other environmentally sensitive locations.

A revised EPA policy document on offshore exploration and development has been developed and will be released in the near future. The revised policy takes account of:

- submissions received on Bulletin 679;
- the "APEA Review" (Swan *et al*, 1994);
- the report of the Marine Parks and Reserves Selection Working Group (1994); and
- the WA Government's 1994 'New Horizons in Marine Management' policy statement (Government of Western Australia, 1994).

The revised policy document will set out in detail the EPA's approach to environmental risk assessment for offshore drilling proposals, including consideration of proximity to sensitive environments, and, where known, the type of petroleum (oil, condensate or gas).

<u>Oil spill risks from shipping</u>

The EPA has noted that the proposed Wonnich gas development project would not result in any increased tanker traffic in the area. However the EPA is aware that, in general, the greatest risk of oil spills in the marine environment comes not from petroleum exploration and production but from tankers and general shipping traffic. The EPA is of the view that, as a basis for strategic maritime planning, more information is required about oil spill risks from tankers and other shipping on the Western Australian coast.

The EPA recommends that, as a basis for strategic maritime planning, the State Committee for Combating Marine Oil Pollution, with technical assistance from the Department of Environmental Protection, should commission a quantitative risk assessment of current and projected shipping movements along the Western Australian coast. The aim of the risk assessment should be to identify high risk areas for shipping accidents, and to make recommendations on appropriate risk reduction measures. The assessment should include a comparison of the risks from Australian and foreign flag shipping.

The EPA submits the following recommendations:

Recommendation 1

That the Minister for the Environment note the report on the relevant environmental factors, including the EPA objectives for each factor (Section 3).

Recommendation 2

That the Minister for the Environment note that the EPA has concluded that, if the proposed project is implemented according to the EPA's recommended conditions and procedures (Section 4), the EPA's objectives can be met.

Recommendation 3

That the Minister for the Environment set the conditions and procedures detailed in Section 4 of this report.

Recommendation 4

That the Minister for the Environment note the EPA's other advice (Section 5) and write to the State Committee for Combating Marine Oil Pollution to initiate a study of risks associated with tanker and other shipping traffic along the Western Australian coast.

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Appendices

1. Introduction and Background

Apache Northwest Pty Ltd (a wholly owned subsidiary of Apache Energy Limited) proposes to develop the Wonnich gas/condensate field situated some 25 kilometres north-west of Varanus Island and 8 kilometres south-west of the Montebello Islands (Figure 1, Appendix 1). Two production wells would be drilled about 3 kilometres west of the Montebello barrier reef.

The development of the Wonnich gas/condensate field follows Ampolex Limited's drilling of the Wonnich 1 exploration well in 1995, which resulted in a hydrocarbon discovery in the Flag Sandstone formation. Production testing assessed a 77 metre column of gas-condensate reservoir fluid overlying an 8 metre column of oil. The Wonnich-1 well was assessed by the EPA in Bulletin 780 (1995) and was drilled without incident. The proposed Wonnich gas/condensate production wells would be located close to the site of the Wonnich-1 exploration well.

The Wonnich oil prospect is being further evaluated through the drilling of the Wonnich appraisal wells which were separately assessed by the EPA in Bulletin 853 (1997).

The Wonnich field is situated in an area classified as a "Sensitive Marine Environment" by the EPA (1993). The intertidal margins of the Montebello Islands are a "C" Class Conservation Park. The coral reefs, mangroves, and shallow marine environments of the area are considered to have high conservation significance. This was recognised in the report of the Marine Parks & Reserves Selection Working Group (1994), which recommended that the waters around the Montebello Islands be declared an "A" Class reserve.

The islands of the Montebello group are an "A" Class Conservation Park, while the islands of the Lowendal group are "C" Class Conservation Park. Both island groups are important habitats for resident and migratory sea birds.

In view of the environmental sensitivity of the area, the EPA required the Wonnich gas development proposal to be formally assessed at the level of Consultative Environmental Review (CER). The CER (Apache Energy Ltd, 1996) was made available for public comment for a month, closing on 9 December 1996. A list of organisations which made submissions is given in Appendix 2. The proponent has released as a separate document the DEP's summary of public submissions and the proponent's responses to the relevant issues raised (Apache Energy Ltd, 1997).

2. The Proposal

The proponent (Apache Northwest Pty Ltd) proposes to develop the Wonnich field located in Permit TP/8 (Figure 1, Appendix 1), about 8 km west-south west of Hermite Island, one of the Montebello Islands.

Apache Energy Ltd proposes to drill two wells from a single location. The proposal is for gas/condensate production only. No oil would be produced as part of the proposed development. The development would consist of an unmanned, offshore production monopod tied back via a sub-sea pipeline to the existing Apache processing facilities on Varanus Island. No additional processing facilities would be constructed in connection with the proposed project.

The proponent has advised that there would be no additional tanker traffic from the proposed project. This is because there will be excess tanker capacity due to declining production from the existing Harriet project on Varanus Island.

Existing quarantine arrangements approved by CALM would be strictly enforced to prevent the introduction of weeds or animals (eg rats and mice) onto Varanus Island.

The proposed life of the project is ten to fifteen years. The main features of the proposal are summarised in Table 1. Further information can be found in the proponent's CER document (Apache Energy Ltd, 1996b).

Table 1. Summary of Project

	Description
Type of rig	Jack-up drilling rig
Location	The Wonnich field is located 8 km west-southwest of Hermite Island
Number of wells	Two production wells, drilled from the same location
Depth of wells	2300 m - 2400 m
Depth of water	27 m
Drilling fluid	A palm oil formulation based on non-aromatic esters would be used. Such drilling fluids have low toxicity to marine life.
Drilling period	35 days
Monopod	Based on a braced monopod design with a total height of about 29 m above sea level. It is designed for automatic operation and would be unmanned except for routine maintenance and wireline work. Fluids would be co-mingled with gas for export via a sub-sea pipeline to existing facilities on Varanus Island for separation and processing.
Artificial lighting	There will be a requirement for a navigational warning light (a single flashing white light) on the monopod. This would have no significant impact on turtles or other animals.
Characteristics of Wonnich condensate	Typical North West Shelf condensate API^{0} gravity is approximately 56 and containing about 12% aromatics. Low pour point ($<0^{0}C$), high flash point ($24^{0}C$) and relatively high viscosity (0.87 cst $20^{0}C$).
Toxicity of Wonnich condensate	Independent laboratory analyses commissioned by the proponent show that the toxic components of Wonnich condensate are primarily BTEX (benzene, toluene, ethyl-benzene, and xylene). These components would evaporate within 2 hours of spillage.
Length of pipeline	31 km
Pipeline Route	Southwards from Wonnich Gas for 17 km and then runs parallel to the existing East Spar pipeline for 16 km. The pipeline would come ashore at Varanus Island close to the existing East Spar pipeline shore crossing.
Pipeline shore crossing	The pipeline would cross the Varanus Island shoreline adjacent to the existing East Spar pipeline. Rehabilitation methods would be the same as have been used with the East Spar and Agincourt pipelines.
Pipeline corrosion protection	The pipeline would be protected from corrosion using chemical treatment. "Pigs" (intelligent and non-intelligent) would be used to inspect the pipeline for corrosion damage at regular intervals.
Export of product	Gas would be exported through the existing Varanus Island gas export line. Condensate would be exported from Varanus Island by tanker. The proponent predicts there would be no need for additional tanker traffic as a result of the proposed project, since there will be excess tanker capacity as a result of declining production from the existing Harriet project.
Produced formation water (PFW)	PFW would be disposed of down a deep injection well on Varanus Island. The proposed deep injection well would be subject to a separate Works Approval under the Environmental Protection Act.
Oil spill contingency plan	There is an existing approved oil spill contingency plan for Apache operations in the area. A supplement will be prepared dealing with contingency plans for condensate spills. A specialised "Jackson net" boom suitable for condensate spills will be available.
Decommissioning	At the end of the project, the proponent proposes to remove the monopod for onshore disposal or re-use. The proponent proposes to leave the sub-sea pipeline in situ. However, under the Petroleum (Submerged Lands) Act, complete removal of all structures (including the pipeline) would be required, except with the agreement of the Minister for Mines.

3. Relevant Environmental Factors and Risk

3.1 Relevant Environmental Factors

It is the opinion of the EPA, having given appropriate consideration to the submissions from organisations listed in Appendix 2, and material referenced in Appendix 3, that the following are the environmental factors relevant to the proposal:

- sea floor
- produced formation water
- condensate and diesel (from accidents)
- coral reefs
- island shores
- mangroves
- turtles and dugong
- seabirds

These relevant environmental factors are discussed in sections 3.2 to 3.9 below.

Use of environmental risk in this report

The draft EPA policy on the offshore petroleum industry (EPA, 1993) states that:

> 'In areas of the highest sensitivity, proposals may not be considered acceptable unless it can be shown that any associated risks are small and any impacts are manageable'.

The Wonnich gas development location is within an area designated as an "environmentally sensitive area" by the EPA (EPA, 1993) and inside an area recommended as a marine reserve (Marine Parks and Reserves Selection Working Group, 1994). The drilling location is relatively close to sensitive marine habitats of high conservation significance, including coral reefs and intertidal areas. The EPA has therefore assessed the proposal through a consideration of environmental risk and other technical issues.

The concepts of risk assessment and management are well established for human health and safety applications. However, the application of risk assessment and management to the environmental effects of hydrocarbon spills is still in its infancy. A definition of environmental risk, following Warner (1993), is as follows:

> Environmental risk is a measure of potential threats to the environment taking into account, firstly, the probability that events will cause or lead to environmental degradation, and, secondly, the potential severity of that degradation.

For the purposes of this report, and following usual risk considerations, hydrocarbon spill risk has been considered in terms of four levels of risk, namely:

- primary risk: the probability of a hydrocarbon spill, and the volume of that spill at source, from the drilling operations and equipment failure; from production operations; from pipeline leakage; or from an accident to a workboat;
- secondary risk: the probability of a hydrocarbon spill travelling on the water surface and reaching a sensitive part of the environment;
- tertiary risk: the probability that the sensitive part of the environment will suffer degradation, and the form and extent of that degradation; and

- quaternary risk: the probability that sensitive parts of the environment will recover from the influence of the hydrocarbon spill, and the form and extent of that recovery.

The primary and secondary risks can be estimated quantitatively, but there is insufficient information to quantify the tertiary and quaternary risks and they can only be estimated qualitatively. There are few comparative data available to assess the acceptability of the overall risk.

3.2 Sea floor

3.2.1 Aspects of the sea floor

Aspects of the sea floor are discussed in relation to potential impacts:

- at the development site; and
- along the pipeline route

3.2.1.1 Development site

A survey of the seabed features was undertaken by RACAL Survey Australia Ltd (1996). The survey indicated that the sea floor at the proposed development site lies at a depth of 27 metres. To the east of the site, the sea floor rises from this depth to 5 metres over a distance of about 3 kilometres. To the west of the site, the sea floor slopes away more gradually to reach depths of 40 meters over a distance of some 6 kilometres.

Previous studies by Ampolex (Dr I Stejskal, Apache Energy Limited, *pers. comm.*) show that the sea floor at the proposed development site consists of limestone pavement that is either covered with sheets of mobile, coarse white calcareous sand or thinly veneered and sparsely colonised with algae and other marine life. The species of algae and other forms of attached marine life in the immediate area are widespread species not considered to be of high conservation significance.

A number of activities may disturb the sea floor at the development site. These include:

- stabilisation of the drilling rig and supply vessels;
- disposal of drill cuttings;
- installation of the monopod;
- decommissioning of the monopod.

Stabilisation of the drilling rig and anchoring of the supply vessels

A self-elevating, cantilever jack-up rig would be used for the Wonnich gas development. It would be towed into position - about 8 kilometres off Hermite Island - by two support vessels, and the three legs jacked down on the sea floor.

The weight of the jack-up drilling rig would result in the formation of a depression in the sea floor at each of the sites where the legs are positioned. The area and depth of the leg imprints into the sea floor would be dependent on the weight of the rig and the substrate type - the area of the depression is estimated at about $10.6m^3$ for each of the three legs (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*).

The rig would be positioned in an area devoid of coral or other sensitive habitats. A detailed geotechnical study would be made to locate a suitable location for the rig. Anchoring of the rig and the supply vessels would be confined to sand/limestone pavement areas. The proponent has made a commitment that anchoring would not be allowed on, or adjacent to, coral reefs or ‘bommies’ or in the vicinity of known shipwreck sites (Apache Energy Ltd, 1996b). The proponent will liaise with the WA Museum on the location of shipwrecks in the area (Apache Energy Ltd, 1996b).

Before drilling operations commence, routine precautions would be undertaken by the drilling contractor to ensure the stability of the drilling rig and to minimise the risk of movement during a storm.

Disposal of drill cuttings

Drill cuttings are crushed rock particles generated by the drill bit and brought to the surface in the drilling fluid. The inert rock particles vary in size from silt to gravel. During the drilling of the top 25 metres section of the well (36 inch diameter hole), about $20m^3$ of drill cuttings would be deposited on the seabed adjacent to the well.

In the section of the well between the base of the 36 inch diameter hole and the bottom of the second well section (up to 1,100 meters), no drill cuttings would be returned to the surface - the cuttings are lost in the porous formation or “lost circulation zone” (Apache Energy Ltd, 1996b).

The drill cuttings from the deeper sections of the well would be brought to the surface, separated through the solids removal process on the rig and, once treated, would be reinjected down the annulus of the well.

The area of sea floor subject to impact, given the quantity of the cuttings, should be no greater than 10m diameter around the well. The discharge of this small volume of drill cuttings would cause short-term, localised turbidity and the burial of some marine life in the immediate vicinity of the rig. However, the high energy of the open ocean would disperse these materials quickly and recolonization would be rapid. There would be no oil residues on the drill cuttings.

Installing the monopod

The installation of the production monopod would result in the localised disturbance of the seabed sediments and associated seabed flora and fauna. It would also cause an increase in turbidity of the surrounding water in the short term. Disturbed sediments around the monopod would rapidly stabilise and be recolonised by marine life.

The proponent has made a commitment to install the monopod outside of the annual coral spawning period (Apache Energy Ltd, 1996b). In Western Australia, the main coral spawning event occurs 7 to 10 days after the full moon in March. Possible impacts to coral gametes and spawn would therefore be eliminated.

The monopod would progressively become encrusted with marine life. The proponent has made a commitment not to use TBT-based antifouling paints on the monopod or other sub-sea structures. Marine growth on the monopod would instead be controlled by a mechanical scraper (Apache Energy Ltd, 1996b).

Decommissioning the monopod

At the end of the field life - within ten to fifteen years - decommissioning of the field and removal, disposal or re-use of the monopod would be required under the Western Australian *Petroleum (Submerged Lands) Act 1982*.

The proponent has made a commitment not to use any explosives for removal purposes. Instead, the monopod would be cut away by mechanical means (Apache Energy Ltd, 1996). The wells would be sealed off and made safe as required under the *Petroleum (Submerged Lands) Act*.

3.2.1.2 Pipeline Route

The proponent investigated three possible routes for the sub-sea pipeline (Apache Energy Ltd, 1996b). The routes investigated are illustrated in Figure 2 (Appendix 1).

Route Selection

The proponent has selected Route 1 as the preferred route based on both environmental and logistical grounds. The proponent states that Route 1 would result in environmental damage "no greater than for the majority of other North West Shelf pipelines" (Apache Energy Ltd, 1996b).

The proponent has established that installation, post-installation stabilisation and inspection and maintenance of a pipeline along either Route 2 or Route 3 would be complex because of the presence of shallow water. Routes 2 and 3 were also found to pass across areas of reef. The extent of the reef was such that it could not be by-passed.

The preferred route, Route 1, is 31 km in length. From the Wonnich monopod site, it runs southwards for 16 km. It then reaches the existing East Spar pipeline and runs parallel to it for 15 km, coming on shore at Varanus Island. The last 7 km - closest to Varanus Island - lies in shallow water (about 2 m). The pipeline would cross the shoreline of Varanus Island adjacent to the landfalls of the existing East Spar and Agincourt pipelines.

Based on survey results, the proponent (Apache Energy Ltd, 1996b) states that the majority of seabed on Route 1 is calcarenite with occasional overlying pockets of sand. For the first 16 km from the monopod, the pipeline would lie in water 13 m to 31 m deep. Close to the East Spar pipeline, the water is shallower (8-13 m deep).

The proponent has determined that Route 1 would pass to the west and well clear of the western barrier reef area at all points. As illustrated in Figure 1 (Appendix 1), Route 1 avoids all areas of coral reef, mangroves, seagrass and algal beds. Route 1 (the preferred route) is therefore the route with least environmental impact.

Installing the pipeline

The proponent (Apache Energy Ltd, 1996b) states that the offshore section of the pipeline would be laid by conventional barge. The eight 5 tonne anchors would cause local damage at the point where they are dropped.

To stabilise the pipeline, a shallow barge supporting rock bolting operations would operate with a multi-point mooring system. Limited quantities of drill cuttings and grout may settle on the seabed (Apache Energy Ltd, 1996b).

The pipeline corridor (the width of the corridor over which the pipelines and anchors may contact the sea floor during installation) which would be required for installation and stabilisation would be 500 m in width - 250 m on either side of the laydown barge. The actual pipelines and tie-downs will be less than 1 metre wide (Apache Energy Ltd, May 1997).

Apache Energy Ltd (1996) has determined that installing and stabilising the pipeline would result in the loss of a small area of seabed and increased turbidity during installation. The negative impacts would thus be transitory and localised. In the longer term, marine life will be attracted to the structure which would function as a linear "artificial reef".

To minimise any possible environmental impacts, the proponent has made a commitment to refrain from carrying out work during the coral spawning period (Apache Energy Ltd, 1996b).

At the shoreline crossing onto Varanus Island, rehabilitation of coastal landforms and vegetation would be carried out according to the requirements of CALM, using the same methods as have been used for the existing East Spar and Agincourt pipeline shore crossings.

Pipeline commissioning

As part of the commissioning process, hydrotest fluid (sea water) will be pumped into the pipeline. This process tests the integrity of the pipeline. Anti-corrosion chemicals and biocides (to kill sulphur-reducing bacteria which promote pipeline corrosion) are added to the hydrotest fluid. The proponent has made a commitment that, at the completion of hydrotesting, the hydrotest fluids will be pumped into the bunded area on Varanus Island, and subsequently will be disposed of into the deep disposal well. This will avoid any potential for marine pollution from this source.

Decommissioning

Decommissioning would occur 10 to 15 years from the start of production. Prior to decommissioning, Apache Energy Ltd has stated it would consult with all relevant parties including the DME, DEP, CALM, fishing and conservation groups.

Apache Energy Ltd (1996) has proposed that the pipeline would be cleaned out, opened at both ends to seawater and left *in situ* to disintegrate naturally. However, under the *Petroleum (Submerged Lands) Act*, the proponent would be required to completely remove the pipeline at decommissioning, except with the agreement of the Minister for Mines.

Monitoring Commitments

The proponent has made a commitment to undertake a video survey of the seabed at the well site immediately before and after drilling, using a Remotely Operated Vehicle (ROV). This would document the nature of the seabed and associated epifauna (attached marine life) in the immediate vicinity pre- and post-drilling. After drilling, any rubbish remaining on the seabed would be detected and removed and a visual assessment of the extent of the cuttings would be made.

In addition, the proponent has made a commitment to obtain an aerial photographic record of the patch reef to the east of the development before and after drilling and the installation of the monopod. This would be compared with photographs taken prior to the Wonnich exploration phase to establish whether any large scale changes in the condition of the reef have taken place.

3.2.2 Assessment

Disturbance to the seafloor will occur in the immediate vicinity of drilling operations and due to monopod and pipeline installation and decommissioning.

The report of the Marine Parks and Reserves Selection Working Group (1994) concludes that the Barrow, Lowendal and Montebello islands, together with the sub-littoral ridge on which they stand, comprise a geomorphological and ecological unit which is unique on the West Australian coast and which may be regarded as a "distinctive coastal type".

Accordingly, in the opinion of the EPA, the relevant geographic area for the factor "sea floor" is the Barrow-Lowendal-Montebello Island complex.

The EPA's objective with respect to this factor is the maintenance of biodiversity of the sea floor within the relevant geographic area and to ensure that impacts upon locally significant marine flora and fauna communities are avoided.

The EPA notes:

- the proximity of the operations to the coral reefs and other sensitive environments of high conservation significance;
- the primary effects on the sea floor would be localised and limited within an area of 50 m of the facilities and 250 m either side of the pipeline;
- there are no sensitive environments of high conservation significance within the area of primary impact;
- the proponent will carry out a detailed survey of the pipeline route before pipeline laying commences in order to provide a baseline for monitoring. The pipeline will be laid so as to avoid coral bommies and other locally significant features;
- the proponent will carry out video monitoring of the seabed in the immediate vicinity of the production wells before and after drilling;
- the biodiversity of the sea floor in the areas impacted would recover rapidly following installation of the sub-sea structures;

- the proponent has made a commitment not to use TBT-based anti-fouling paint on the sub-sea structures; and
- on completion of hydrotesting, the hydro-test fluids would be stored in the bunded area on Varanus Island, and subsequently disposed of to the deep disposal well. This would avoid any potential for marine pollution or groundwater pollution from this source.

Having particular regard to:

- the high degree of certainty with which the impacts can be predicted; and
- the proposed management options, which would include: limiting anchoring to sandy bottom; reinjecting drill cuttings down the annulus; and the selection of pipeline Route 1 so as to avoid major coral reefs,

it is the EPA's opinion that its objective with respect to the environmental factor "sea floor" can be met provided that:

- the proponent's commitments are made legally enforceable;
- before drilling or construction commence, the proponent's surveys of the monopod and pipeline location to be submitted to the DEP to confirm the acceptability of the locations selected; and
- the proponent submits a decommissioning plan 2 years prior to the earliest date for decommissioning. The plan to be reviewed and approved by the DEP, CALM and the DME.

3.3 Produced Formation Water

3.3.1 Aspects of produced formation water

The proponent indicates that only insignificant amounts of produced formation water (PFW) would be generated by the project initially. However, the proportion of PFW would progressively increase as the reserve is depleted. The total quantity of PFW to be produced during the life of the project (15 years) is estimated to be between 25 and 50 megalitres (Apache Energy Ltd, May 1997). The PFW would be removed from the gas and condensate during processing on Varanus Island and would be disposed of by deep well injection.

The composition of PFW typically includes production chemicals and dissolved and dispersed organic and inorganic compounds. Inorganic compounds include salts, metals and (in some cases) radionuclides. Dissolved organic compounds include highly soluble monocyclic aromatic hydrocarbons, carboxylic acids and phenols and less soluble aliphatics, cyclo-alkanes and polycyclic aromatic hydrocarbons. However, PFW can be classified as "practically non-toxic" according to the EC (European Community) accepted hazard rating (E&P Forum, 1994).

In instances where PFW is discharged into the sea, studies have shown that it has been found to have a low potential for biological impacts. Impacts, where they do occur, are confined to the seafloor or the platform fouling community at the discharge site (E&P Forum, 1994). However there is little information available about the effects of PFW discharges on marine environments on the North West Shelf. Apache Energy Limited and the Australian Petroleum Production and Exploration Association (APPEA) are currently carrying out research on the environmental impacts of PFW disposal to the sea in the Varanus Island area (Mr Niegel Grazia, APPEA, *pers. comm.*).

The reinjection of Wonnich Gas formation water on Varanus Island would eliminate the discharge of the water at sea and any potential for marine impacts. However, potential impacts on groundwater and associated underground animals on Varanus Island need to be considered. One underground species (an undescribed copepod) has so far been detected on Varanus Island (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*).

The well to be employed for reinjection is the existing Alkimos production well. This well has now reached the end of its productive life and would be converted to a deep disposal well. The PFW would be reinjected into the Flag formation which is situated at a depth of 2.3 to 2.5 km and is geologically quite separate and distinct from the shallow strata in which the groundwater layer occurs. In effect, the PFW would be reinjected back into an "empty" petroleum reservoir.

The proposed deep injection well will require separate environmental approval under the Works Approval provisions of the Environmental Protection Act. Under the terms of that approval, there will also be a requirement for annual certification of well casing integrity, and a requirement for approved back-up measures in case of pump failure, or in case the deep injection well should not be useable for other reasons. Finally there will be a requirement for agreed decommissioning procedures to ensure the well is sealed adequately at the end of its life.

3.3.2 Assessment

The disposal of PFW into a deep injection well on Varanus Island could be expected to remove any potential for pollution of the marine environment or groundwater from this source.

In the EPA's opinion, the relevant area for the relevant factor "produced formation water" is the extent of the groundwater resource under, and coastal waters around, Varanus Island.

The EPA's objective with respect to the relevant factor "Produced Formation Water" is the protection of marine water quality and the quality of groundwater on Varanus Island.

The EPA notes:

- the presence of an undescribed species of underground fauna on Varanus Island.

Having particular regard to:

- the proposal to dispose of the PFW into a deep formation which is geologically quite distinct and separate from the shallow groundwater layer;
- the requirement for the proposed deep injection well to be assessed separately under the Works Approval provisions of the Environmental Protection Act;
- the requirement for annual certification of casing integrity;
- the requirement for approved back-up measures (which may include temporary shut-down of operations) in case of pump failure, or in case the deep injection well should for some other reason be out of commission; and
- the requirement for an approved decommissioning plan to ensure the well is effectively sealed at the end of its life,

it is the opinion of the EPA that its objective with respect to the relevant environmental factor "Produced Formation Water" can be met.

3.4 Condensate and diesel (from accidents)

3.4.1 Aspects of condensate and diesel (from accidents)

Potential sources of diesel spills from this type of project are:

- refuelling incidents;
- diesel use and storage on rig; and
- rupture of fuel tank on work boat.

Potential sources of condensate spills from this type of project are:

- well blowouts;

- leakages from test separator; and
- pipeline leakages.

The nature of these incidents and their estimated frequency (ie the primary risk) are discussed below.

Diesel spills

Refuelling incidents

A leakage or spill of diesel fuel could occur as a result of a failure (hose break, coupling failure) of the transfer hose while the drilling rig is being refuelled. The maximum spill from this source is estimated to be 200 litres (EPA, 1997).

The proponent has made a commitment to follow detailed refuelling procedures as follows:

- refuel only during suitable weather and sea conditions (according to criteria to be agreed with the EPA);
- refuel the rig prior to it being brought on site (to minimise the number of refuelling operations required on site);
- fit the transfer hoses with 'dry break' couplings;
- use fuel transfer hoses reinforced with wire mesh;
- install a vacuum breaking system (to drain fuel left in the hose on the completion of the transfer, back to the supply vessel);
- install drip trays beneath the refuelling connections on the supply vessel and the drilling rig;
- transfer fuel in daylight hours;
- refuel only when the prevailing currents are moving away from the adjacent reef system and when sea conditions are sufficiently calm for there to be minimal risk to the transfer lines;
- maintain continuous contact between the drilling rig crew and the workboat crew throughout the refuelling operation;
- store suitable absorbent material on the supply vessel and the drilling rig to mop up small spills;
- contain drainage in areas where hydrocarbons and chemicals are used - drains will be closed to the environment;
- report all spills greater than 80 litres to DME and DEP;

The primary risk associated with rig refuelling incidents, based on the international data, is given in Table 2.

Diesel use and storage on rig

As discussed in the EPA's report on the oil appraisal drilling programme for the Wonnich Field (EPA, 1997) there is potential for spillage from diesel use and storage on the drilling rig.

The main source of a significant diesel spillage is from the drilling rig's fuel tank due to vessel collision. Such an incident is not a credible risk scenario, given that the rig fuel tanks are located too high above the water surface to be impacted by a support vessel (EPA, 1997). Any other minor spillage of diesel on board the rig would be contained within the rig (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*). This potential source of spillage is therefore not considered further in this assessment.

Rupture of fuel tank on support vessel

As indicated in the EPA's assessment of the proposed Wonnich oil appraisal drilling programme (EPA, 1997), another potential source of significant diesel spillage is a rupture of the fuel tank on a support vessel as a result of collision with the rig, or the vessel sinking or grounding.

The maximum spill from such an incident is 80,000 litres (Apache Energy Ltd, 1996b). No quantitative data are available on the probability of such an incident involving vessels. The proponent has therefore used international data on oil spills from diesel storage on rigs.

To reduce the risk of fuel tank rupture on a support vessel, the proponent has made a commitment to undertake work adjacent to the rig or monopod only in suitable weather conditions (to the requirements of the EPA). Support vessels would only approach the rig or monopod at night in an emergency (for example to evacuate personnel).

Primary risks associated with diesel are summarised in Table 2.

Table 2. Primary diesel spill risks (Source: Apache Energy Ltd, 1996b)

EVENT	RUPTURE OF FUEL TRANSFER HOSE	RUPTURE OF FUEL TANK ON SUPPORT VESSEL
Type of spillage	Diesel	Diesel
Estimated maximum quantity (Apache Energy Ltd, 1996b)	200 L	80,000 L
Probability (based on international data)	2.0×10^{-2} during the 35 day drilling period.	7.0×10^{-5} during the 35 day drilling period.
Comment	The amount of spillage will be limited to a maximum of 200 L by the use of "dry break" hose couplings.	Probability estimates are based on probabilities for spills from diesel storage on rigs.

Condensate spills

Blowouts

During production drilling, well workover, and production operations, "kicks" or "blowouts" may occur.

A "kick" is the flow of formation fluids (also called drilling "muds") or gas into the well bore as a result of the pressure in the formation exceeding that of the drilling fluid. The severity of the "kick" depends on the pressure difference between the formation and the drilling fluid and the porosity and permeability of the formation. A "blowout" is an uncontrolled "kick".

"Kicks" and "blowouts" are prevented by maintaining the hydrostatic pressure of the drilling fluid at a level greater than the formation pressure.

An increase in the drilling fluid flow rate and/or bit penetration rate and the presence of gas bubbles in the returned drilling fluid will indicate that a kick is taking place. Steps would then be taken to check for flow from the well, and the well would be shut-in. The well can then be brought under control by adjusting the density and weight of the drilling fluid.

The risk of a hydrocarbon release from a "kick" or "blowout", based on the international data, is shown in Table 3. In assessing the primary risks of blow-out, the proponent has assumed that the automatic gas detection system would trigger the blow out preventers (BOPs) to shut in the well within 10 seconds. On this basis, and taking account of the specific reservoir characteristics, the total volume of condensate released from such an incident would be limited to 19,000 litres only.

Table 3. Primary risk from well blow-out or test separator leakage (Source: Apache Energy Ltd, 1996b)

EVENT	Litres of condensate	FREQUENCY
Blowout		
First year (drilling, completion, production)	19,000	$4.47 \times 10^{-3} yr^{-1}$
Subsequent years	19,000	$2.81 \times 10^{-4} yr^{-1}$
Test separator leak		
Small leak	1,800	$3.19 \times 10^{-4} yr^{-1}$
Large leak	3,000	$3.15 \times 10^{-4} yr^{-1}$

Based on international data, the proponent has estimated the probability of a blowout occurring in the first year of production (drilling, completion and production) and resulting in a maximum spill of 19,000 litres of condensate, as $4.47 \times 10^{-3} yr^{-1}$ or 0.45 % per year (Apache Energy Ltd, 1996b).

The estimated probability of a blowout occurring in subsequent years (including two wireline workovers per year), and resulting in a maximum spill of 19,000 litres is $2.81 \times 10^{-4} yr^{-1}$ or 0.03 % per year.

The proponent (Apache Energy Ltd, 1996b) considers that the above risk estimates are conservative since the Wonnich reservoir pressures are known, state-of-the-art drilling equipment will be used and drilling practices will be at the level of international best practice. That conclusion is confirmed by independent technical advice from DME.

Routine safety procedures required by the DME make the following measures mandatory for drilling operations:

- two or more barriers for the control of well bore pressure (Blow Out Preventers and maintenance of correct mud density);
- routinely testing the Blow Out Preventers stack;
- pressure testing casing strings to a pressure in excess of the reservoir pressure prior to drilling;
- providing well reservoir characteristics to the drilling engineers to allow them to plan for the interception of hydrocarbons during drilling;
- to conduct mud logging techniques to give quantitative measures of the pressure in the formations drilled; and
- to fully train personnel in emergency well control procedures.

Furthermore, to reduce the risk of loss of containment during production, the following valves will be installed:

- a sub-surface safety valve in each well, isolating any flow from the well;
- two surface safety valves on top of each well, isolating any flow; and

- a safety valve isolating the flow from the platform prior to the start of the pipeline (Apache Energy Ltd, May 1997). In the event of cyclonic conditions, Apache's emergency procedures require these valves to be shut down prior to the approach of the cyclone (Apache Energy Ltd, May 1997).

Leakage from the test separator

During the production phase of the project, there is potential for condensate leakages from the test separator on the monopod. (The test separator is used to monitor the characteristics of product entering the pipeline).

The primary risk of leakage from the test separator is summarised in Table 3.

If such a leak occurs, the emergency shut down system will be triggered by the gas leak detection system and the release of gas and associated condensate will be isolated in about 10 seconds (Apache Energy Ltd, 1996b). The total amount of condensate spilled from such an incident would therefore be limited to a maximum of 3,000 litres only.

Leakage from sub-sea pipeline

During the production phase there is a potential for a pipeline leakage or rupture. The volume of condensate released is dependent both on the size and type of the leakage and on the action of the automatic shutdown system. A slow leak (from corrosion pitting) has the potential to produce a larger spill than a complete rupture. This is because of the longer time delay in detection by the automatic system (Apache Energy Ltd, 1996b).

Based on international data, the frequencies of corrosion pitting, a small perforation, large perforation, or a total pipeline rupture has been estimated by the proponent and are summarised in Table 4. Note that these frequency estimates are conservative since corrosion management (including chemical corrosion treatment and use of an "intelligent pig" to regularly monitor the condition of the pipeline) should reduce probabilities of leakage substantially.

Table 4. Primary risks from pipeline leakage (Source: Apache Energy Ltd, 1996b)

Event	Litres of condensate (maximum)	Frequency of event	
		Per kilometre	Route 1 (31 km)
Corrosion pitting (less than 5 mm diameter)	Total 21,000 L (slow leakage continuing over 10 days until visual detection)	3.73×10^{-5} km^{-1} yr^{-1}	1.16×10^{-3} yr^{-1}
Small perforation (greater than 5 mm diameter)	Total 50,000 L (leakage continuing over 10 days until visual detection)	3.74×10^{-5} km^{-1} yr^{-1}	1.16×10^{-3} yr^{-1}
Small perforation (20 mm diameter)	Total 16,000 L (over 2 hours until automatic shutdown)	3.74×10^{-5} km^{-1} yr^{-1}	1.16×10^{-3} yr^{-1}
Large perforation (80 mm diameter)	Total 16,100 L (until automatic shutdown)	3.74×10^{-5} km^{-1} yr^{-1}	1.16×10^{-3} yr^{-1}
Pipeline rupture (250 mm diameter)	Total 18,000 L (until automatic shutdown)	2.49×10^{-5} km^{-1} yr^{-1}	7.7×10^{-4} yr^{-1}

3.4.2 Assessment

For the purposes of the assessment of the relevant environmental factor "Condensate and diesel (from accidents)", the EPA has defined the relevant geographic area to be the Barrow/Lowendal/Montebello Island complex.

The EPA's objective with respect to the environmental factor "Condensate and diesel (from accidents)" is to ensure minimal risk of leakage through the identification and management of risks and adoption of international best practice equipment and operating procedures.

The EPA notes:

- the proximity of the proposed drilling, production monopod and pipeline to sensitive environments of high conservation significance, including coral reefs, island shores, mangroves, and habitats of turtles, dugong and sea birds;
- the concerns expressed in public submissions about the potential for hydrocarbon leakage and the resulting impacts on sensitive environments of high conservation significance;
- a large diesel spill could only occur as a result of a ruptured fuel tank on a work boat (support vessel);
- a potential source of small diesel spills is rig refuelling. The proponent has made a commitment to limit the potential for a spill of this nature through the introduction of a number of safety features and management measures. This would reduce the overall risk from this source;
- a large condensate spill could result from an uncontrolled well blow-out, test separator leak or pipeline rupture;
- based on the international data, the probability of a blowout from the proposed project in its first year (drilling, completion and production) is 4.47×10^{-3} yr^{-1}. The characteristics of the Wonnich reservoir were well established during the Wonnich exploration program and are such that it is therefore unlikely that a blow-out would occur;
- even in the unlikely event that a blow-out should occur, the use of automatic gas detection equipment would mean that the blow-out preventers would very quickly shut-in the well Therefore, only limited quantities of condensate would be produced from a blow-out;
- based on the international data, the probability of a condensate leak from the test separator on the monopod is small, the quantity would be limited (due to the operation of the automatic shut-down system) and evaporation would be rapid. The annual risk and lifetime risk of condensate spills from this therefore are small; and
- the probability of a condensate leakage from the pipeline is small and evaporation of the condensate would be rapid. The actual risk of leakage would be lower than indicated by international statistics since state-of-the-art corrosion management methods (including use of an "intelligent pig") would be used. Furthermore, the quantities of condensate which could be spilled would be limited due to the automatic shut-down system. The annual and lifetime risk of condensate leaks are thus small;

Having particular regard to:

- the potential sources of hydrocarbon leakage from an operation of this type;
- the probability of a well blow-out is low, test separator leak or large pipeline leak is small, and, even if such an incident were to occur, the automatic shut-down system would limit the quantity of condensate spilled;
- the buoyant and highly volatile nature of Wonnich condensate;

- the toxic components in Wonnich condensate would evaporate rapidly (within two hours) following a spill; and
- the proponent's specific commitments to manage risk and protect the environment,

it is the EPA's opinion that its objective with respect to the relevant environmental factor "Condensate and diesel (from accidents)" can be met provided that:

- the proponent puts in place legally binding contract requirements with the drilling contractors, the pipeline contractors and the support vessel operators to ensure environmental best practice; and
- the proponent develops an annex to the existing approved oil spill contingency plan to cover contingency measures for condensate spills.

3.5 Coral reefs

3.5.1 Aspects of coral reefs

Aspects of the coral reefs

A coral reef comprises a complex community of organisms including corals, sponges, molluscs, fish, crustaceans, algae and many other forms of marine life. The following assessment therefore considers not just corals, but the coral reef community as a whole.

Conservation values of the Montebello reefs

Information on the marine conservation values of the Montebello Islands can be found in EPA Bulletin 853 (EPA, 1997). The waters around the Montebello Islands are considered to be of particular conservation significance and have been recommended as an A class marine reserve (Marine Parks and Reserves Selection Working Group, 1994). In addition, the Australian Heritage Commission proposes to list the Montebello Islands marine area (including the coral reefs) on the Register of the National Estate (K Bossard, Australian Heritage Commission, *pers. comm.*).

There are no species of coral known to be endemic to (ie. unique to) the Montebello Islands (Apache Energy Limited, 1996b). This is expected since most species of corals (and many other species of marine life) on the North West Shelf are widespread tropical Indo-Pacific species.

A survey by the Australian Institute of Marine Science (AIMS) found a number of new species of sponges in shallow water (less than 10 metres deep) in the northern lagoon of the Montebello Islands (Dr R McCauley, AIMS, *pers. comm.*). These sponges have not been found elsewhere, however further survey work would be needed to determine whether they are unique to the Montebello Islands (Dr J Hooper, Queensland Museum, *pers. comm.*; Dr R McCauley, AIMS, *pers. comm.)*. Diving surveys commissioned by the proponent, and carried out by staff from the Sydney University Marine Laboratory, have shown that there are very few sponges on the reefs close to the project location (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*).

Conservation values of reef adjacent to production well location

The closest coral reef to the well location is the patch reef about 1 km to the east (Figure 1, Appendix 1). Another similar reef is located about 5 km almost due south of the project location. A channel approximately 15 m deep separates the two reefs. The reefs form part of the string of patch reefs to the west of the Montebello Islands which have been collectively referred to as "the western barrier reef" (Berry, P F, 1993) or the "west fringing reef" (Apache Energy Limited, 1996b).

Surveys carried out for the proponent (Apache Energy Limited, 1996b) indicate that the seaward (western) side of the reef is dominated by algae (*Halimeda* species and a variety of other species). There is reported to be very little coral growth on the seaward side of the reef (Apache Energy Limited, 1996b). The reef crest is mainly bare limestone and is exposed at most low tides (Apache Energy Limited, 1996b). Behind the reef crest is a zone of seasonal large brown algae of the genus *Sargassum* (M Forde, consultant, *pers. comm.*).

The proponent's field surveys showed there were good stands of branching coral (*Acropora* spp) on the lagoon (eastern) side of the reef. There is no estimate available of the total area of live coral cover on the reef, nor of the total area of intertidal coral cover (Apache Energy Limited, 1996b).

The smaller patch reef located 5 km south of the drilling location is similar to the reef to the east, but is entirely subtidal (Dr I Stejskal, Apache Energy, *pers. comm.*).

Lowendal Islands

There are no coral 'reefs' in the strict sense around the Lowendal Islands. However there are a number of coral 'bommies' (also called coral 'heads') in the area.

Secondary risk - risk of a condensate or diesel spill reaching coral reefs of the Montebello or Lowendal Islands

Diesel spills from ruptured work boat fuel tank

The secondary risks associated with a workboat accident (collision between work boat and rig) would be lower than those associated with the Wonnich oil appraisal program (EPA, 1997), since the gas development wells would be about 2 km further away from the coral reefs and other sensitive environments.

Well blow-out

Any spillage from a well blow-out would be gas/condensate only (no oil would be produced). The emergency shut-down system would be triggered by gas detection, isolating the release of gas and condensate in approximately 10 seconds. The DME has confirmed that this is a reasonable assumption. The estimated release of condensate under this scenario would be a maximum of 19,000 litres (Apache Energy Ltd, 1996b: figures 16 and 17).

The proponent has estimated secondary risks for well blow-outs from the proposed project using a computerised oil spill trajectory model - "OILMAP/OILTRAK". Under worst case conditions (summer, onshore winds), the proponent's trajectory predictions indicate that condensate could reach the nearest coral reef in 3 hours. The proponent estimates the overall risk to the reef (primary and secondary risk combined) from this source is 5.6×10^{-4} per year (one chance in 1,786 per year).

Spreading and evaporation of condensate would be rapid (Figure 3, Appendix 1). At a water temperature of 26^{0}C, about 70% of the total volume of condensate spill will evaporate within sixty minutes. About 15% - 20% of the total condensate will resist evaporation and would persist for another 7 days. Allowing for evaporation and dispersion, the trajectory model indicates that a total of only seven (7) litres of condensate would reach the adjacent reef (Apache Energy Ltd, May 1997).

Independent technical advice from the DME indicates that, even in the extremely unlikely event of an uncontrolled blow-out (complete failure of blow-out preventers and all other safety mechanisms), most of the condensate would in fact be jetted into the air as a fine mist under pressure of the escaping gas. DME advises that the main risk under such a scenario would be risk to human health and safety from fire and explosion.

Spills from pipeline leaks

Table 5 summarises the secondary risks of a pipeline leakage at different locations. Only the "highest risk" scenarios are included.

Apache's OILMAP oil spill prediction model indicates the probability that the shores or reefs of the Montebello Islands, Lowendal Island and Barrow Island would be impacted by a spill from a pipeline leak, should a leak occur. The probabilities assume automatic detection (detection by gas metering anomalies) and shutdown except for small leaks remote from Varanus Island and corrosion pitting and small leaks near Varanus Island (visual detection). The DME has confirmed that these are reasonable assumptions.

Small perforations in the pipeline may result in larger spills of condensate than a large perforation or even a pipeline rupture. This is because of the time lapse before detection and isolation during which there would be continued leakage of condensate.

The results indicate a low overall risk of condensate reaching the adjacent reef and shorelines of the Montebello Islands both in the first year and in subsequent years. The risk assessment indicates that there is a low overall risk of condensate reaching the western barrier reef andshorelines of the Montebello Islands, but a higher overall risk of condensate reaching the Lowendal Islands. The worst case scenarios (largest quantities of condensate predicted to reach reef or shoreline) for pipeline leakage would be a small perforation (5 mm diameter) 2-3 km off Varanus Island, or a large perforation 500 m off Varanus Island.

Oil spill contingency plan

Under the petroleum legislation administered by the DME, the proponent is required to have an effective oil spill contingency plan. There is an existing approved oil spill contingency plan for Apache operations in the Montebello/Varanus Island area. Before the project commences, the DME will require the proponent to produce an annexe to the contingency plan dealing with condensate spillages. As is normal procedure, the DME would seek advice from the DEP and the State Committee for Combating Marine Oil Pollution before approving the annexe.

A specialised boom ("Jackson sea net") suitable for use with condensate would be available to contain or deflect condensate spills (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*).

Tertiary risks- potential impacts on coral reefs

General information on the effects of hydrocarbon spills on coral reef ecosystems can be found in EPA Bulletin 853 (EPA, 1997).

Tertiary risks from the proposed Wonnich gas development are summarised in Table 6. The tertiary risk estimates take into account the estimated quantities of condensate or diesel reaching reefs under the various scenarios, allowing for evaporation and dispersion.

Ruptured work boat fuel tank

The worst case scenario for diesel spillage would be a rupture of a workboat fuel tank which could result in a spill of 80,000 litres of diesel. As noted previously, the proposed Wonnich gas project would not result in any increased tanker traffic in the area since there will be excess tanker capacity as a result of declining production from the existing Harriet project on Varanus Island. Spills from tankers are therefore not considered here.

As described in EPA Bulletin 853 (EPA, 1997), the proponent has carried out oil spill trajectory modelling for a spill of 80,000 litres of diesel from rupture of a work boat fuel tank. The modelling is for a collision between a work boat and rig at the Wonnich *oil appraisal* location, situated 1 km west of the nearest reef. The proponent estimates that, allowing for evaporation, a cumulative total of 13,000 litres could reach the coral reefs and island shorelines. There would be severe impacts on the two adjacent patch reefs if they were exposed by low tide at the time of the spill. If the reefs were covered by high water, there would probably still be significant impacts as a result of the action of surf breaking on the reefs and dispersing oil into the water column.

Table 5. Secondary risks from pipeline leakage (Source: data supplied by Apache Energy Ltd)

Event	Secondary risk (over entire 15 year project lifetime)	Impact location	Probability of contact (%)		Total volume of condensate reaching location (litres)	
			Summer	Winter	Summer	Winter
Within first kilometre of sub-sea pipeline						
Small perforation - greater than 5 mm diameter (Total 21,000 L over 2 days)	4.0×10^{-4}	West fringing reef Northern Reef Southern Reef Southern Islands Hermite Island	90 70 30 30 15	40 0 40 40 4	224 184 5 10 10	5 0 77 3 <1
Corrosion pitting at the monopod location - less than 5 mm diameter (Total 50,000 L over 10 days)	1.8×10^{-4}	West fringing reef Southern Islands Southern Reef	16 2 0	40 40 30	62 <1	38 35 50
2 km - 3 km off Varanus Island						
Small perforation - greater than 5mm diameter (Total 21,000 L over 2 days)	4.1×10^{-4}	Bridled Island Varanus Island	70 40	80 20	813 283	294 14

Note: secondary risk is the combined probability that a spill will occur and will reach reefs and/or shoreline.

Table 5. continued

Event	Secondary risk (over entire 15 year project lifetime)	Impact location	Probability of contact (%)		Total volume of condensate reaching location (litres)	
500 m off Varanus Island			Summer	Winter	Summer	Winter
Small perforation - 20mm diameter (Total 16,000 L over 2 hours)	1.7×10^{-4}	Bridled Island Varanus Island	10 90	20 36	41 199	31 67
Large perforation - 80 mm diameter (Total 16,100 L)	1.3×10^{-4}	Varanus Island Bridled Island	70 21	36 24	1,201 61	494 345
Full bore rupture - 250 mm diameter (Total 18,000 L)	7.3×10^{-5}	Varanus Island	60	35	479	38
Corrosion pitting - less than 5 mm diameter (Total 8,000 L over 2 days)	2.3×10^{-4}	Bridled Island Varanus Island	100 80	30 50	5 203	35 123

A spill of this kind from the Wonnich *gas* location (2 km further away) should result in less severe impacts, since the diesel spill would have to travel a further two kilometres before reaching the reef. This would allow for additional evaporation and dispersion. However, there is obviously a potential for greater impacts if a work boat were to run aground or sink closer to reefs or shorelines.

Well blow-out

It is predicted that there would be negligible (if any) environmental impacts to coral reefs from a well blow-out since this would be a gas/condensate blow-out only. Total quantities of condensate spilled would be limited by the operation of the automatic shut-down system.

Independent laboratory analyses commissioned by the proponent (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*) indicate that the toxic components of Wonnich condensate are primarily BTEX (benzene, toluene, ethyl-benzene, and xylene). These components would evaporate within 2 hours of spillage (before contacting the closest reef).

Leak from test separator

It is predicted that there would be negligible (if any) environmental impacts to coral reefs from a leak of condensate from the test separator. This is because the total quantity of condensate spilled would be limited by the operation of the automatic shut-down system. As noted, the toxic components of condensate would evaporate before reaching reefs or other sensitive areas.

Pipeline leakage

The worst case scenarios (largest quantities of condensate predicted to reach reef or shoreline) for pipeline leakage would be a small perforation (5 mm diameter) 2-3 km off Varanus Island, or a large perforation 500 m off Varanus Island. This could result in acute (short term) toxic impacts to marine life (see Table 6). As noted previously, due to the way the automatic detection system works, a larger leakage of condensate could result from a *small* perforation (such as from corrosion pitting).

Quaternary risk - potential for recovery of coral reefs

General information on the recovery of coral reef systems from oil spill impacts can be found in EPA Bulletin 853 (EPA, 1997). Possible recovery times from various possible incidents associated with the Wonnich gas development are given in Table 6. The incidents with the greatest potential for long-term impacts are a workboat accident (resulting in a diesel spill), or a leak of condensate from the pipeline near the shore of Varanus Island.

Monitoring program

The proponent has made a commitment to carry out ecological monitoring of the reefs and adjacent shallow water environments. The monitoring program has been designed with advice from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Marine Laboratory of Sydney University (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*).

3.5.2 Assessment

The report of the Marine Parks and Reserves Selection Working Group (1994) concluded that the Barrow, Lowendal and Montebello islands, together with the sub-littoral ridge on which they stand, comprise a geomorphological and ecological unit which is unique on the West Australian coast and which may be regarded as a "distinctive coastal type".

Accordingly, the EPA's opinion is that the relevant area for assessing the impact of the proposal on the relevant factor "coral reefs" is the Montebello-Lowendal-Barrow Islands complex.

Table 6. Summary of risks from the Wonnich gas project (Sources: Apache Energy Ltd, 1996b; Volkman et al, 1994; IPIECA 1992; IPIECA, 1993).

Event	Primary risk - estimated risk of event	Secondary risk - estimated probability of event occurring and spill reaching sensitive habitat(s)	Tertiary risk - estimated extent and severity of impact	Quaternary risk - estimated recovery time
Drilling rig refuelling incident. (Maximum 200 litres diesel).	2.0×10^{-2} for a 25 day drilling period.	After weathering and dispersal, very little, if any, diesel fuel would reach reefs or other sensitive areas	Negligible impacts.	No significant long-term impacts
Rupture of workboat fuel tank. (Maximum 80,000 litres of diesel).	7.0×10^{-5} during 25 day drilling program. (Based on probability for spill from diesel storage on rigs).	1.4×10^{-5} for a 25 day drilling program. Maximum volume weathered diesel reaching Montebello reefs / islands = 13,000 litres. Minimum time to impact = 14 hours.	Potential for significant impacts on coral reefs, shoreline, mangroves and on populations of seabirds. Some individual turtles and dugongs might be affected, however it is unlikely there would be significant impacts on populations of these animals.	Recovery of coral reefs, shoreline and seabird populations may take many years, depending on severity and extent of impacts. Mangroves may take decades to recover. It is unlikely there would be significant long-term impacts on turtle or dugong populations.

Table 6. continued

Event	Primary risk - estimated risk of event	Secondary risk - estimated probability of impact	Tertiary risk - estimated extent and severity of impact	Quaternary risk - estimated recovery time
Well blow-out during drilling and first year of production - maximum spill of 19,000 litres condensate before automatic shut-down. NOTE: this assumes the blow out preventers would automatically shut-in the well within 10 seconds.	4.4×10^{-3} yr^{-1} (first year)	8.9×10^{-5} yr^{-1}. Maximum volume weathered condensate reaching Montebello reefs / islands = 13 (thirteen) litres. Minimum time to impact = 3 hours.	Negligible if any impacts.	No significant long-term impacts.
Well blow-out during subsequent years of production - maximum spill of 19,000 litres condensate before automatic shut-down. NOTE: this assumes the emergency shut-down valves would automatically shut-in the well within 10 seconds.	2.81×10^{-4} yr^{-1}	5.62×10^{-6} yr^{-1}. Maximum volume condensate reaching Montebello reefs / islands = 13 (thirteen) litres. Minimum time to impact = 3 hours.	Negligible if any impacts.	No significant long-term impacts
Leak of condensate from test separator. (Maximum of 3,000 litres condensate before automatic shutdown within 10 seconds).	3.15×10^{-4} yr^{-1}	1.54×10^{-4} over 15 year project lifetime Maximum volume condensate reaching Montebello reefs / islands = litres. Minimum time to impact = 3 hours.	Negligible if any impacts.	No significant long-term impacts.

Table 6 continued.

Event	Primary risk - estimated risk of event	Secondary risk - estimated probability of impact	Tertiary risk - estimated extent and severity of impact	Quaternary risk - estimated recovery time
Leak within first kilometre of sub-sea pipeline				
Condensate leak from pipeline - corrosion pitting of less than 5mm diameter. (Leakage of 21,000 litres over 10 days before visual detection).	3.73×10^{-5} km^{-1} yr^{-1}	4×10^{-4} over 15 year project lifetime. Maximum volume weathered condensate reaching Montebello reefs / islands = 62 litres. Minimum time to impact = 3 hours.	Potential for minor impacts on coral reefs and shorelines of Montebello Islands.	No significant long-term impacts.
Condensate leak from pipeline - small perforation (greater than 5mm diameter) at monopod site. (Leakage of 50,000 litres over 10 days before visual detection).	3.74×10^{-5} km^{-1} yr^{-1}	1.8×10^{-4} over 15 year project lifetime. Maximum volume weathered condensate reaching Montebello reefs / islands = 224 litres. Minimum time to impact = 3.5 hours.	Minor impacts only.	No significant long-term impacts.
2 km - 3 km off Varanus Island				
Condensate leak from pipeline - small perforation 5mm diameter. (Total leakage of 21,000 L over 2 days before visual detection)	3.73×10^{-5} km^{-1} y^{r-1}	4.0×10^{-4} over 15 year project lifetime. Maximum volume weathered condensate reaching coral bommies / shoreline = 813 litres. Minimum time to impact = 2 hours.	Potential for acute (short-term) toxic impacts on coral bommies and shorelines of Lowendal Islands.	Coral bommies and rocky shorelines = 1-5 yrs. Sand beaches - several years depending on degree of oil penetration.

Table 6. continued.

500 m off Varanus Island				
Condensate leak from pipeline - small perforation 20mm diameter. (Total leakage 16,000 litres over two hours before automatic shutdown).	$3.74 \times 10^{-5} km^{-1} yr^{-1}$	1.7×10^{-4} over 15 year project lifespan. Maximum volume condensate reaching coral bommies / shoreline = 199 litres. Minimum time to impact =2 hours.	Potential for acute (short-term) toxic impacts on coral bommies and shorelines of Lowendal Islands.	Coral bommies and rocky shorelines = 1-5 yrs. Sand beaches - several years depending on degree of oil penetration.
Condensate leak from pipeline - large perforation, 80 mm diameter. (Total leakage 16,100 litres before automatic shutdown).	$3.74 \times 10^{-5} km^{-1} yr^{-1}$	1.3×10^{-4} over 15 year project lifespan. Maximum volume condensate reaching coral bommies / shoreline = 1,202 litres. Minimum time to impact = 2 hours.	Potential for acute (short-term) toxic impacts on coral bommies and shorelines of Lowendal Islands.	Coral bommies and rocky shorelines = 1-5 yrs. Sand beaches - several years depending on degree of oil penetration.
Condensate leak from pipeline, 500 m from Varanus I - full bore rupture. (Total spill of 18,000 litres before automatic shutdown).	$2.49 \times 10^{-5} km^{-1} yr^{-1}$	7.3×10^{-5} over 15 year project lifespan. Maximum volume condensate reaching coral bommies / shoreline = 479 litres. Minimum time to impact = 2 hours.	Potential for acute (short-term) toxic impacts on coral bommies and shorelines of Lowendal Islands.	Coral bommies and rocky shorelines = 1-5 yrs. Sand beaches - several years depending on degree of oil penetration.
Condensate leak from pipeline - corrosion pitting. (Total leakage of 8,000 litres over two days before visual detection).	$3.74 \times 10^{-5} km^{-1} yr^{-1}$	2.3×10^{-4} over 15 year project lifespan. Maximum volume condensate reaching coral bommies / shoreline = 203 litres. Minimum time to impact = 2 hours.	Potential for acute (short-term) toxic impacts on coral bommies and shorelines of Lowendal Islands.	Coral bommies and rocky shorelines = 1-5 yrs. Sand beaches - several years depending on degree of oil penetration.

The EPA's objective with respect to the relevant environmental factor "coral reefs" is to maintain the abundance, biodiversity, productivity and geographic distribution of the marine life of the coral reefs.

The EPA notes:

- the proximity of the drilling location to coral reefs and other sensitive environments;
- public concerns about the potential for environmental impacts;
- the primary risk of a spill of condensate or diesel is low; and
- both diesel and condensate would evaporate and disperse relatively rapidly.

Having particular regard to:

- the proximity of the drilling location to coral reefs and other sensitive environments;
- the potential sources of condensate or diesel spillage from a project of this type; and
- the proponent's specific commitments to manage risk and protect the environment,

it is the EPA's opinion that its objective for the environmental factor "coral reefs" is unlikely to be compromised provided that:

- the proponent prepares an annex to the existing oil spill contingency plan. The annex should detail specific contingency measures for condensate spills.

3.6 Island shores

3.6.1 Aspects of the island shores

The closest land to the proposed location of the gas production wells is the south-west shoreline of Hermite Island (Figure 1, Appendix 1). The shore is rocky and consists of a low limestone cliff cut by a tidal platform (Berry, 1993). A conspicuous zone of rock oysters (*Saccostrea cucculata*) occurs on the limestone cliff (Berry, 1993). At the southern tip of Hermite Island is the embayment of Claret Bay which contains a stand of mangroves. Another sensitive locality, Sherry Lagoon, is located to the east of Claret Bay. A number of smaller rocky islands occur off the southern tip of Hermite Island.

The extensive shallow water lagoon formed by the Montebello Islands is important as the only marine environment of this type and size in north-west Australia. The island-lagoon formation also provides the most sheltered marine habitat known for this part of the continent (IUCN, 1988). A report by the West Australian Museum (Berry, 1993) notes that:

> 'The total shoreline of infratidal (*sic*) land within the Montebellos group is approximately 210 km in length and significantly longer if the margins of intertidal areas, particularly the western barrier reef, are included. An extensive, shallow intertidal zone is therefore contained within a relatively small area, making it more vulnerable to cyclones or oil spillages than the intertidal zone on a straighter coastline such as is typical along much of the Pilbara coast.'

Berry (1993) also notes that the area is particularly productive:

> 'The high tidal range and resultant exchange of water within the protected lagoons, embayments, and channels provides a physical energy subsidy that contributes towards high biological productivity, resulting in an unusual abundance of some animals, for example predatory reef fishes. Very large populations of cormorants (hundreds) and terns (thousands) are also indicative of high biological productivity.'

Secondary risk - risk of a spill reaching shores of the Montebello or Lowendal Islands

Diesel spills from ruptured work boat fuel tank

As noted previously, the secondary risks associated with a workboat accident (collision between work boat and rig) would be lower than those associated with the Wonnich oil appraisal program (EPA, 1997), since the gas development wells would be about 2 km further away from the coral reefs and other sensitive environments.

Well blow-out

The proponent's trajectory predictions indicate that negligible, if any, condensate would reach island shorelines as a result of a well blow-out.

Leak from test separator

The proponent's trajectory predictions indicate that negligible, if any, condensate would reach island shorelines as a result of a leak from the test separator.

Pipeline leaks

Table 5 summarises the secondary risks of a pipeline leakage at different locations. Only the "highest risk" scenarios are included.

Apache's OILMAP oil spill prediction model indicates the probability that the shores of the Montebello Islands, Lowendal Island and Barrow Island would be impacted by a spill from a pipeline leak, should a leak occur. The probabilities assume automatic detection (detection by gas metering anomalies) and shutdown except for small leaks remote from Varanus Island and corrosion pitting and small leaks near Varanus Island (visual detection). The DME has confirmed that these are reasonable assumptions.

The results indicate a low overall risk of condensate reaching the adjacent reef and shorelines of the Montebello Islands both in the first year and in subsequent years. The risk assessment indicates that there is a low overall risk of condensate reaching the western barrier reef and shorelines of the Montebello Islands, but a higher overall risk of condensate reaching the Lowendal Islands. The worst case scenarios (largest quantities of condensate predicted to reach reef or shoreline) for pipeline leakage would be a small perforation (5 mm diameter) 2-3 km off Varanus Island, or a large perforation 500 m off Varanus Island.

Oil spill contingency plan

Under the petroleum legislation administered by the DME, the proponent is required to have an effective oil spill contingency plan. There is an existing approved oil spill contingency plan for Apache operations in the Montebello/Varanus Island area. Before the project commences, the DME will require the proponent to produce an annex to the contingency plan dealing with condensate spillages. As is normal procedure, the DME would seek advice from the DEP and the State Committee for Combating Marine Oil Pollution before approving the annex.

A specialised boom ("Jackson sea net") suitable for use with condensate would be available to contain or deflect condensate spills (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*).

Tertiary risks- potential impacts on shorelines of the Montebello and Lowendal Islands

General information on the effects of hydrocarbon spills on intertidal and shallow water marine communities can be found in EPA Bulletin 853 (EPA, 1997).

Tertiary risks from the proposed Wonnich gas development are summarised in Table 6. The tertiary risk estimates take into account the estimated quantities of condensate or diesel reaching reefs under the various scenarios, allowing for evaporation and dispersion.

Ruptured work boat fuel tank

The worst case scenario for diesel spillage would be a rupture of a workboat fuel tank which could result in a spill of 80,000 litres of diesel.

As described in EPA Bulletin 853 (EPA, 1997), the proponent has carried out oil spill trajectory modelling for a spill of 80,000 litres of diesel from rupture of a work boat fuel tank at the Wonnich *oil appraisal* location, situated 1 km further west of Hermite Island. The proponent estimates that, allowing for evaporation, a cumulative total of 13,000 litres could reach the coral reefs and island shorelines.

A spill of this kind from the Wonnich *gas* location (2 km further away) should result in less severe impacts, since the diesel spill would have to travel a further two kilometres before reaching the island shoreline. This would allow for additional evaporation and dispersion. However, there is obviously a potential for greater impacts if a work boat were to run aground or sink closer to reefs or shorelines.

Well blow-out

It is predicted that there would be negligible (if any) environmental impacts to island shorelines from a well blow-out since this would be a gas/condensate blow-out only. Total quantities of condensate spilled would be limited by the operation of the automatic shut-down system.

Independent laboratory analyses commissioned by the proponent (Dr I Stejskal, Apache Energy Ltd, *pers. comm.*) indicate that the toxic components of Wonnich condensate are primarily BTEX. These components would evaporate within 2 hours of spillage (before reaching reefs or shorelines).

Leak from test separator

It is predicted that there would be negligible (if any) environmental impacts to island shorelines from a leak of condensate from the test separator. This is because the total quantity of condensate spilled would be limited by the operation of the automatic shut-down system.

Pipeline leakage

The worst case scenarios (largest quantities of condensate predicted to reach reef or shoreline) for pipeline leakage would be a small perforation (5 mm diameter) 2-3 km off Varanus Island, or a large perforation 500 m off Varanus Island. This could result in acute (short term) toxic impacts to marine life (see Table 6). As noted previously, due to the way the automatic detection system works, a larger leakage of condensate could result from a *small* perforation (such as from corrosion pitting).

Quaternary risk - potential for recovery of shoreline communities

General information on the recovery of intertidal and shallow water marine communities from oil spill impacts can be found in EPA Bulletin 853 (EPA, 1997. Possible recovery times from various possible incidents associated with the Wonnich gas development are given in Table 6. The incidents with the greatest potential for long-term impacts are a workboat accident or pipeline leak near the shore of Varanus Island.

3.6.2 Assessment

The report of the Marine Parks and Reserves Selection Working Group (1994) concluded that the Barrow, Lowendal and Montebello islands, together with the sub-littoral ridge on which they stand, comprise a geomorphological and ecological unit which is unique on the West Australian coast and which may be regarded as a "distinctive coastal type".

Accordingly, the EPA's opinion is that the relevant area for assessing the impact of the proposal on the relevant factor "coral reefs" is the Montebello-Lowendal-Barrow Islands complex.

The EPA's objective with respect to the relevant environmental factor "island shores" is to maintain the abundance, biodiversity, productivity and geographic distribution of the marine life of the island shores.

The EPA notes:

- the proximity of the project location to island shores and other sensitive environments; and
- the primary risk of a condensate or diesel spill from a project of this type is low;

Having particular regard to:

- the proximity of the project location to island shores and other sensitive environments;
- the potential sources of condensate or diesel spillage from an operation of this type;
- the low probability of a significant condensate or diesel spill from the proposed project; and
- the proponent's specific commitments to manage risk and protect the environment,

it is the EPA's opinion that its objective for the environmental factor "island shores" is unlikely to be compromised provided that:

- the proponent's commitments are made legally enforceable.
- the proponent prepares an annex to the existing oil spill contingency plan, which details contingency measures for condensate spills.

3.7 Mangroves

3.7.1 Aspects of the mangroves

Several pockets of mangroves and associated salt marshes and mudflats occur along the coastlines of the Montebello Islands (see Figure 1, Appendix 1). The main mangrove areas are located on the eastern side of Hermite Island, on the opposite side of the island from the project location. This includes the mangroves within Stevenson Passage (a blind channel which penetrates 8 km into the interior of Hermite Island). A report by the Western Australian Museum (Berry, 1993) states that there is a small stand of mangroves in Claret Bay at the southern tip of Hermite Island. These mangroves are the closest to the project location. There are also mudflats in Sherry Lagoon to the east of Claret Bay. Mangroves species recorded at the Montebellos are: *Avicennia marina*, *Brugueira exaristata*, *Ceriops tagal* and *Rhizophora stylosa* (Semeniuk *et al*, 1978).

In addition, some individual mangrove trees (*Avicennia marina*) are found on the western side of Varanus Island close to the site of the proposed shoreline crossing for the sub-sea pipeline.

Secondary risk - risk of a condensate or diesel spill reaching mangrove areas

The main areas of mangroves are situated on the eastern side of Hermite Island and therefore far from the site of the production wells and the route of the sub-sea pipeline. There is no quantitative estimate of the probability of a spill of condensate or diesel oil spill from the project reaching the main mangrove areas, but, based on the proponent's trajectory predictions, the probability would be very low indeed.

The oil spill response strategy for protection of mangroves, as detailed in the oil spill contingency plan, is summarised in EPA Bulletin 853 (EPA, 1997; Appendix 3). The proponent's oil spill contingency plan states that mangrove and mudflat areas would be given the highest priority for protection. In the event that an oil spill were to occur under conditions such that a spill could reach these areas, the contingency plan calls for a boom to be deployed so as to deflect the spill away from mangrove areas. The proponent will have a specialised boom ("Jackson sea net") available which is suitable for use with condensate spills.

The mangrove trees on the western shore of Varanus Island would be particularly vulnerable to a condensate leak from the sub-sea pipeline close to the island shore.

Tertiary risk - potential impacts of a condensate or diesel spill

Mangroves can be killed by oil covering the trees' breathing pores or by toxicity of substances in the oil, especially lower molecular weight aromatic which damage cell membranes in the sub-surface roots. This in turn impairs the normal salt exclusion process, and the resulting influx of salt is a stress to the plants (IPIECA, 1993).

The organisms among and on the mangrove trees are affected in two ways. First there may be heavy mortalities as a direct result of the oil. For example, oil may penetrate burrows in the sediments, killing crabs and worms, or coat molluscs on the sediment surface and aerial roots. Second, dead trees rot quickly, leading to loss of habitat for organisms living in the branches and canopy of the trees, and in the aerial roots (IPIECA, 1993).

Salt marshes and intertidal mudflats are also particularly sensitive to oil pollution (IPIECA, 1991). Impacts include death of salt marsh plants and death of crabs, worms and other fauna. Oil may enter burrows of marine animals, killing the occupants, and leading to chronic contamination of sub-surface sediments.

Quaternary risk - potential long-term consequences

General information on the potential for recovery from oil spill damage to mangroves can be found in EPA Bulletin 853 (EPA, 1997). Of all marine habitats, mangroves, saltmarshes and mudflats are considered most sensitive to hydrocarbon pollution (Volkner *et al*, 1993). As noted in Table 6, mangroves may take decades (or more) to recover from an oil spill.

3.7.2 Assessment

In the EPA's opinion, the relevant area for assessing the impact of the proposal on the relevant factor "mangroves" is the Montebello-Lowendal-Barrow Islands Complex

The EPA's objective in relation to the environmental factor "mangroves" is to maintain the biodiversity, productivity and geographic distribution of the plants and animals of the mangrove communities.

The EPA notes:

- the proximity of the project to the mangrove communities on Varanus Island;
- by contrast, the major mangrove communities at the Montebello Islands are on the east side of the archipelago, and therefore relatively remote from the project location;
- the primary risk of a condensate or diesel spill from the project is low;
- if significant quantities of diesel or condensate were to reach mangrove areas there would be direct mortality of mangrove trees from absorption of toxic compounds through the roots. Oil would also enter burrows of marine animals, killing the occupants, and leading to chronic contamination of sub-surface sediments.
- recovery of mangrove communities where extensive contamination has occurred could take tens of years. Rehabilitation of affected areas would be difficult and expensive and would involve replacing contaminated sediments and replanting mangroves and other plants.

Having particular regard to:

- the potential sources of condensate or diesel spillage from an operation of this type;
- the low probability of a significant spill of condensate or diesel from the proposed project;
- if an oil spill were to reach mangrove areas, there is potential for significant long-term environmental impacts; and
- the proponent's specific commitments to manage risk and protect the environment.

It is the EPA's opinion that its objective with respect to the relevant environmental factor "mangroves" is most unlikely to be compromised, provided that:

- the proponent's commitments are made legally enforceable;
- the proponent to develop an annexe to the existing oil spill contingency plan. The annexe to detail specific contingency measures for condensate spills.

3.8 Turtles and dugong

3.8.1 Aspects of turtles and dugong

Turtles

Two species of sea turtle, the green turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelis imbricata*), have been recorded nesting at the Montebello and Lowendal Islands (Serventy and Marshall 1964; Apache Energy Ltd, 1996a). CALM has advised that other turtle species which may occur in the area are the flatback turtle (*Chelonia depressa)*, and the loggerhead turtle (*Caretta caretta*).

The loggerhead turtle is listed under Schedule 1 (fauna rare or likely to become extinct) of the Wildlife Protection Act 1950, and as endangered under the Commonwealth Endangered Species Act 1992. The green and hawksbill turtles are not listed under the Wildlife Protection Act but are listed nationally as vulnerable and internationally (by the World Conservation Union) as endangered. The flatback turtle is an Australian endemic of uncertain conservation status (Dr R Prince, CALM, *pers. comm.*).

The green, hawksbill and loggerhead turtles are also protected under the Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention), to which Australia is a signatory.

The western reefs of the Montebellos are reported to be used by feeding turtles (Deegan, 1992). In addition, large numbers of turtles have been reported by several observers in most of the inter-island channels, the tidal lagoons and around the mangrove systems (Deegan, 1992). Adult green turtles are herbivores which feed on seagrasses and algae. Hawksbill turtles feed almost exclusively on sponges. Flatback and loggerhead turtles are carnivores which apparently eat a wide variety of marine animals (Dr R Prince, CALM, pers. comm.).

There are some small sandy beaches on the south-western shore of Hermite Island which are potential breeding sites for a small number of turtles. However, the major turtle breeding beaches are on the opposite (eastern) side of the archipelago on North West and Trimouille Islands (Apache Energy Limited, 1996b). Turtles also breed at Varanus Island and the other islands of the Lowendale group (Dr I Stejskal, Apache Energy, *pers. comm.*).

CALM has advised that, although sea turtles are widespread migratory species, breeding animals typically return either to the nesting beach where they originally hatched, or to nearby beaches. It is therefore likely there are genetically distinct sub-populations of turtles which breed on the beaches of the Montebello-Lowendal-Barrow Island complex.

Dugong

The dugong or sea cow (*Dugong dugon*), a herbivorous marine mammal, is listed under Schedule 4 (other specially protected fauna) of the Wildlife Protection Act 1950. Dugongs have been reported at the Montebellos, but there have been no systematic surveys of these animals in the area (Deegan, 1992). CALM has advised that, while it is not known if dugongs breed around the Montebello-Lowendal-Barrow island complex, it is likely there are individuals which are resident in the area.

Secondary risk - risk of an oil spill reaching turtles, dugong and their habitats

The proponent's trajectory predictions indicate that diesel or condensate spillage could not reach the main turtle nesting beaches on the eastern side of the Montebello Islands within 48 hours (Dr I Stejskal, Apache Energy Limited, *pers. comm.*). However, a small beach on the east side of Ah Chong Island and used for nesting by hawksbill turtles (EPA, 1997; Figure 3, Appendix 1) could be impacted within that time period.

Beaches on the west of Varanus Island could be impacted by a spill of condensate from a leak of the sub-sea pipeline.

The turtle breeding season is in the summer months. The worst case scenarios would therefore be:

- a diesel spill from a workboat accident during summer; or
- a condensate leak from the sub-sea pipeline near Varanus Island during summer.

The proponent's oil spill response strategy, as detailed in the oil spill contingency plan is summarised in EPA Bulletin 853 (EPA, 1997; Appendix 3). The plan states that turtle nesting beaches would be given high priority for protection. In the unlikely event that a spill of diesel or condensate were to occur, and conditions were such that the spill could reach turtle nesting beaches, the plan calls for oil spill booms to be deployed so at to deflect the spill away from the beaches. The proponent will have available a special boom ("Jackson sea net") for use with condensate spills.

In the event a spill of condensate or diesel was to reach the reefs or coastal waters of the Montebello or Lowendal Islands during winter, there is potential for contact with individual turtles. Individual dugong could come in contact with a spill at any time of the year.

Tertiary risk - potential impacts on turtles, dugong and their habitats

General information on the impacts of oil pollution on sea turtles and dugong can be found in EPA Bulletin 853 (EPA, 1997). Adult and hatchling turtles may be affected if breeding beaches are contaminated. Dugongs and turtles in the water could be injured by condensate or diesel coming in contact with the animals' skin or eyes. The animals could also be affected by inhaling toxic fumes from a hydrocarbon spill.

Quaternary risk - potential long-term consequences on turtles, dugong and their habitats

Although some individual turtles or dugongs might be affected, it is unlikely that a spill of diesel or condensate from the proposed project would have significant long-term consequences for populations of turtles and dugong or their habitats. The worst case scenario would be significant contamination of turtle breeding beaches. As noted above, this is most unlikely since the major turtle nesting beaches in the area are located on the eastern side of the Montebello Islands, relatively remote from the project location.

It is most unlikely that a spill of condensate or diesel would result in significant contamination of food sources of turtles and dugong. This is because both diesel and would evaporate and degrade relatively rapidly in the marine environment. In addition, the toxic components of condensate are volatile and would evaporate within 2 hours. Such toxins would not result in significant contamination of marine food chains through bioaccumulation or biomagnification.

3.8.2 Assessment

The EPA's opinion is that the relevant area for assessing the impact of the proposal on the relevant factor "turtles and dugong", is the Montebello-Lowendal-Barrow Islands Complex.

The EPA's objective in relation to the relevant factor "turtles and dugong" is to avoid impacts on turtles, dugong, and their habitats, to meet the requirements of the Wildlife Conservation Act and the Commonwealth Endangered Species Act, and to adhere to national and international legal obligations.

The EPA notes:

- the proximity of the project location to habitats of turtle and dugong, including turtle breeding beaches;
- the main turtle breeding beaches in the area are located on the eastern side of the Montebello group and are therefore relatively remote from the project location;
- the primary risk of a spill of diesel or condensate from the project is low;
- based on the proponent's spill trajectory predictions, and the bouyant and volatile nature of both condensate and diesel, secondary risks are also low;
- even in the unlikely event that a diesel or condensate spill were to occur, some individual turtles or dugongs might be affected, however it is most unlikely that there would be significant long-term consequences for populations of turtles or dugongs or for their food resources.

Having particular regard to:

- the potential sources of oil spillage from an operation of this type;
- the low probability of a significant spill of diesel or condensate from the proposed project;

- the fact that condensate and diesel will evaporate and degrade relatively rapidly in the marine environment and will not lead to significant long-term contamination;
- the proponent's specific commitments to manage risk and protect the environment.

It is the EPA's opinion that its objective with respect to the relevant environmental factor "turtles and dugong" is unlikely to be compromised, provided that:

- the proponent to prepare an annexe to the existing oil spill contingency plan. The annexe to detail specific contingency measures for condensate spills.

3.9 Sea birds

3.9.1 Aspects of sea birds

The Montebello and Lowendal Islands provide habitat for at least 26 species of seabirds and waders (Serventy and Marshall, 1964; Burbidge 1971). Thirteen species of birds listed on one or both of the China-Australia Migratory Bird Agreement and the Japan-Australia Migratory Bird Agreement have been recorded at the Montebello Islands. CALM has advised that the Montebello Islands are one of the most important tern (mainly bridled terns, *Sterna anaethetus*) nesting areas in Western Australia. The Montebello islands are also a breeding place for the beach thick knee (*Escacus magnirostris neglectus*) which is nationally vulnerable (Burbidge, 1971; Marine Parks and Reserves Selection Working Group, 1994). The islands are also important breeding sites for wedgetailed shearwaters (*Puffinus pacificus chrolorhynchus*).

Secondary risk - risk of a condensate or diesel spill affecting sea birds

Resident birds such as cormorants (*Phalacrocorax* spp), white breasted sea eagles (*Haliaeetus leucogaster*) and ospreys (*Pandion haliaetus*), and shore birds such as the beach thick knee (*Esacus magnirostris neglectus*) would be present year round and would be potentially vulnerable to spills throughout the year.

Migratory birds could be affected if spill were to occur during the summer period when these species are present. Migratory shore birds feed predominantly on mudflat areas. Such habitats occur mainly on the eastern side of the Montebello Islands (relatively remote from the proposed project). Other migartory species such as the bridled tern and wedgetailed shearwater feed in the open ocean and are potentially vulnerable to spills in open water.

Tertiary risk - potential impacts of a condensate or diesel spill on sea birds

Effects of hydrocarbon pollution on sea birds can include both lethal and sub-lethal effects. Birds could be impacted directly by contact with a spill, or indirectly by consuming fish or other prey contaminated with toxic components of the spill (Volkner *et al*, 1993). Sub-lethal effects may include impacts on reproduction. There is evidence that even a single dose of petroleum hydrocarbons ingested by a bird can result in altered yolk structure and reduced hatchability of eggs laid subsequently (Grau *et al*, 1977).

The worst case scenario would be a spill of diesel from a workboat accident (such as collision of a work boat with a rig). In the worst case, such an accident might result in large numbers of individual birds. Swimming and diving species such as cormorants and shearwaters would be particularly vulnerable (Volkner *et al*, 1993).

Quaternary risk - rate of recovery of sea bird populations following a spill of condensate or diesel

The rate at which bird populations would recover from a spill event would depend on the severity and extent of impacts. Recovery of populations from a severe event could be expected to take a number of years at least.

As noted previously, a spill of Wonnich condensate or diesel would not result in significant long term (chronic) toxic contamination of fish and other marine life through bioaccumulation or biomagnification. The food sources of sea birds would not therefore be subject to long-term contamination.

3.9.2 Assessment

The EPA notes:

- the importance of the Montebello and Lowendal Islands as habitat for migratory and resident sea birds;
- the main feeding areas for shore birds are likely to be the mudflat areas which are mainly situated on the east side of the Montebello Islands (and therefore relatively remote from the project location);
- birds such as bridled terns and shearwaters which feed in the open ocean are potentially vulnerable to contact with spills in open water. Swimming and diving birds such as cormorants are also particularly vulnerable;
- effects of hydrocarbon pollution on birds can include effects on reproduction. Even a single dose of oil ingested by a bird may affect egg viability;
- the worst case scenario would be a large diesel spill resulting from a work boat accident.

Having particular regard to:

- the low probability of a condensate or diesel spill from the proposed project; and
- condensate and diesel will evaporate and degrade relatively rapidly in the marine environment and will not lead to significant long-term contamination.

It is the EPA's opinion that it is most unlikely that its objective with respect to the relevant factor "sea birds" would be compromised, provided that:

- the proponent to prepare an annex to the existing oil spill contingency plan. The annexe to detail specific contingency measures for condensate spills.

4. Conditions and Procedures

4.1 Conditions

(a) the proponent's environmental management commitments as set out in the CER, and as subsequently modified during the assessment process, to be made legally binding.

(b) before construction commences, the proponent shall carry out detailed surveys of the seabed to determine suitable locations for the monopod and pipeline, to the requirements of the Minister for the Environment, on advice of the EPA, in consultation with the DEP, DME and CALM;

(c) the proponent to put in place legally-binding contract requirements with the drilling and pipeline contractors, and with the support vessel operators, to achieve environmental best practice (to be agreed), to the requirements of the EPA on advice of the DEP and the DME.

(d) in order to manage the relevant environmental factors and EPA objectives contained in this bulletin, and subsequent environmental conditions and procedures authorised by the Minister for the Environment, the proponent is required to prepare, prior to implementation of the proposal, an environmental management system, including an environmental management program, in accordance with recognised environmental management principles, such as those in Australian Standards AS/NZS ISO 14000 series.

(e) the proponent to prepare a decommissioning plan at least two years prior to decommissioning, to the requirements of the EPA, on advice of the DEP, DME and CALM.

4.2 Procedures

Deep injection well

The proposed deep injection well will require separate approval under the Works Approval provisions of the Environmental Protection Act.

Contingency measures for condensate spills

Under the provisions of the Petroleum (Submerged Lands) Act administered by the Department of Minerals and Energy, the proponent will be required to prepare an annex to the existing oil spill contingency plan and which will detail the contingency measures applicable to a spill of condensate. The annex will be prepared to the requirements of the Department of Minerals and Energy on advice of the State Committee for Combating Marine Oil Pollution and the Department of Environmental Protection.

5. Other advice

<u>EPA policy on offshore petroleum drilling</u>

The EPA's policy on petroleum drilling near coral reefs and other environmentally sensitive areas is at present being revised in light of new information.

EPA Bulletin 679 'Protecting the marine environment - a guide for the petroleum industry' was released as a public discussion paper in 1993 (EPA, 1993). The main purpose of Bulletin 679 was to provide guidance on levels of environmental assessment for offshore petroleum proposals.

A number of submissions were received from the industry and from conservation groups in response to Bulletin 679. Industry's main concern centred on the issue of exploration in marine parks and reserves and the statement in the Bulletin that there would be a presumption against approval in these areas. Conservation groups expressed opposition to all petroleum drilling in marine reserves or any other environmentally sensitive locations.

A revised EPA policy document on offshore exploration and development has been developed and will be released in the near future. The revised policy takes account of:

- submissions received on Bulletin 679;
- the "APEA Review" (Swan *et al*, 1994);
- the report of the Marine Parks and Reserves Selection Working Group (1994); and
- the WA Government's 1994 'New Horizons in Marine Management' policy statement (Government of Western Australia, 1994).

The revised policy document will set out in detail the EPA's approach to environmental risk assessment for offshore drilling proposals, including consideration of proximity to sensitive environments, and, where known, the type of petroleum (oil, condensate or gas).

Oil spill risks from shipping

The EPA has noted that the proposed Wonnich gas development project would not result in any increased tanker traffic in the area. However the EPA is aware that, in general, the greatest risk of oil spills in the marine environment comes not from petroleum exploration and production but from tankers and general shipping traffic. The EPA is of the view that, as a basis for strategic maritime planning, more information is required about oil spill risks from tankers and other shipping on the Western Australian coast.

The EPA is aware that ANZECC has commissioned a study to identify sensitive marine areas Australia-wide and to identify appropriate measures to make shipping aware of these areas.

The EPA recommends that, to complement the ANZECC study, the State Committee for Combating Marine Oil Pollution, with technical assistance from the Department of Environmental Protection, commission a quantitative risk assessment of current and projected shipping movements along the Western Australian coast. The aim of the risk assessment should be to identify high risk areas for shipping accidents and to make recommendations on appropriate risk reduction measures. The assessment should include a comparison of the risks from Australian and foreign flag shipping.

6. Recommendations

The EPA submits the following recommendations:

Recommendation 1

That the Minister for the Environment note the report on the relevant environmental factors, including the EPA objectives for each factor (Section 3).

Recommendation 2

That the Minister for the Environment note that the EPA has concluded that, if the proposed project is implemented according to the EPA's recommended conditions and procedures (Section 4), the EPA's objectives can be met.

Recommendation 3

That the Minister for the Environment impose the conditions and procedures set out in Section 4 of this report.

Recommendation 4

That the Minister for the Environment note the EPA's other advice (Section 5) and write to the State Committee for Combating Marine Oil Pollution to initiate a study of risks associated with tanker and other shipping traffic along the Western Australian coast.

Table 7. Summary of relevant environmental factors, environmental objectives, proponent's commitments and EPA's opinions

Relevant environmental factor	Environmental objective	Proponent's commitments	EPA opinion
Sea floor	Maintain the biodiversity of the sea floor and ensure that impacts on locally significant marine flora and fauna communities are avoided.	• A detailed survey of the marine and terrestrial habitats along the pipeline route will be made to ensure that no sensitive assemblages will be adversely affected. • A detailed procedure for the pipeline trench excavation and subsequent rehabilitation will be given to the contractors prior to commencement of installation. This procedure will be developed in consultation with the DEP and CALM. • Intallation of the pipeline and monopod will occur outside the coral spawning season. • Hydrotest fluid will be disposed of to the bunded area on Varanus Island and subsequently down the deep disposal well. • Prior to drilling, and at the completion of the program, ROV surveys of the sea floor will be conducted. Any rubbish on the seafloor will be removed.	The EPA's objective can be met provided that: • before construction commences, the proponent's seabed surveys of monopod and pipeline location to be submitted to the DEP, CALM and the DME to confirm acceptability of location selected; • the proponent to submit a decommissioning plan at least two years prior to the earliest date for decommisioning. The plan to be reviewed and approved by DEP, CALM and DME.
Produced formation water	Protect marine water quality and the quality of groundwater under Varanus Island.	• Produced formation water will be disposed of to a deep disposal well on Varanus Island.	The EPA's objective can be met since the deep disposal well would allow disposal of PFW into a deep structure which is geologically separate from the shallow groundwater layer. The deep disposal well will be subject to separate assessment under the Works Approval provisions of the Environmental Protection Act.

Table 7. continued

Relevant environmental factor	Environmental objective	Proponent's commitments	EPA opinion
Condensate and diesel (from accidents)	Ensure minimal risk of leakage by identifying and managing risks and by adopting international best practice equipment and operating procedures.	• Special rig refuelling procedures will be used (see main text for details).	Risks of condensate spillage will be reduced through use of automatic detection and shut-down equipment. Therefore, even if a well blow-out or pipeline rupture were to occur, only limited quantities of condensate could escape . With respect to diesel spills, the EPA's objective can be met provided that: • The proponent puts in place legally binding contract requirements with the drilling and pipeline contractors, and with the support vessel operators to ensure environmental best practice.
Coral reefs	Maintain the biodiversity, productivity and geographic distribution of the marine life of the coral reefs.	• Prior to the commencement of drilling, an annexe to the existing oil spill contingency plan will be prepared. The annexe will deal specifically with condensate spills. The annexe will be to the requirements of the EPA, on advice of the DEP, DME and CALM. • special booms for use with condensate will be available.	It is most unlikely that the EPA's objective would be compromised.
Island shores	Maintain the biodiversity, productivity and geographic distribution of the plants and animals of the island shore	• Prior to the commencement of drilling, an annexe to the existing oil spill contingency plan will be prepared. The annexe will deal specifically with condensate spills. The annexe will be to the requirements of the EPA, on advice of the DEP, DME and CALM. • special booms for use with condensate will be available.	It is most unlikely that the EPA's objective would be compromised.

Table 7. continued

Mangroves	Maintain the biodiversity, productivity and geographic distribution of the plants and animals of the mangroves, saltmarshs and mudflats.	• Prior to the commencement of drilling, an annexe to the existing oil spill contingency plan will be prepared. The annexe will deal specifically with condensate spills. The annexe will be to the requirements of the EPA, on advice of the DEP, DME and CALM. • special booms for use with condensate will be available.	It is most unlikely that the EPA's objective would be compromised.
Turtles and dugong	To avoid impacts on turtles and dugong and their habitats, to meet the requirements of the Wildlife Conservation Act and the Commonwealth Endangered Species Act, and to adhere to national and international legal obligations.	• Prior to the commencement of drilling, an annexe to the existing oil spill contingency plan will be prepared. The annexe will deal specifically with condensate spills. The annexe will be to the requirements of the EPA, on advice of the DEP, DME and CALM. • special booms for use with condensate will be available.	It is most unlikely that the EPA's objective would be compromised.
Sea birds	To avoid impacts on sea birds and their habitats, to meet the requirements of the Wildlife Conservation Act and the Commonwealth Endangered Species Act, and to adhere to national and international legal obligations.	• Prior to the commencement of drilling, an annexe to the existing oil spill contingency plan will be prepared. The annexe will deal specifically with condensate spills. The annexe will be to the requirements of the EPA, on advice of the DEP, DME and CALM. • special booms for use with condensate will be available.	It is most unlikely that the EPA's objective would be compromised.

Appendix 1

Figures

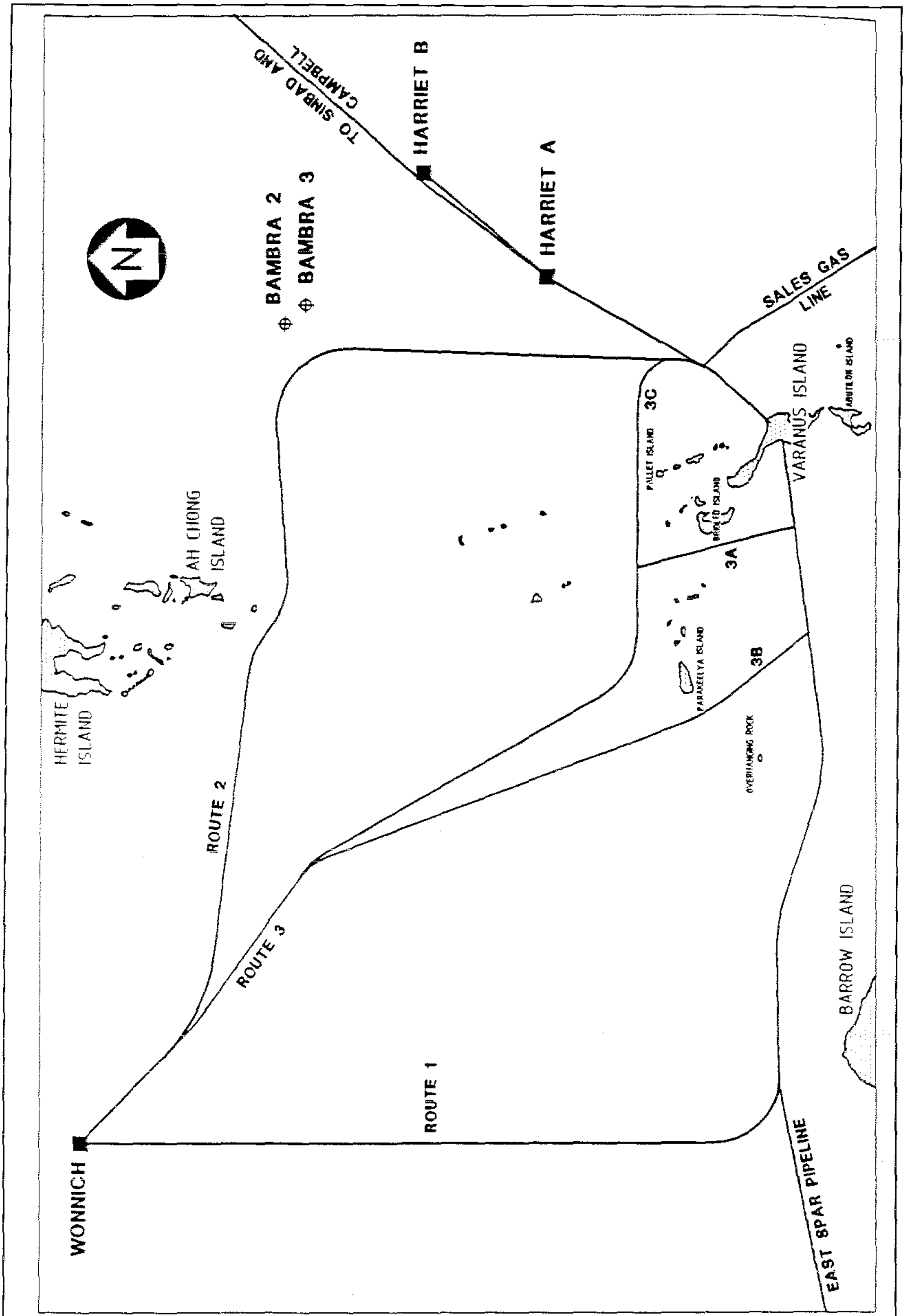

Figure 2. Alternative pipeline routes for the Wonnich gas development.

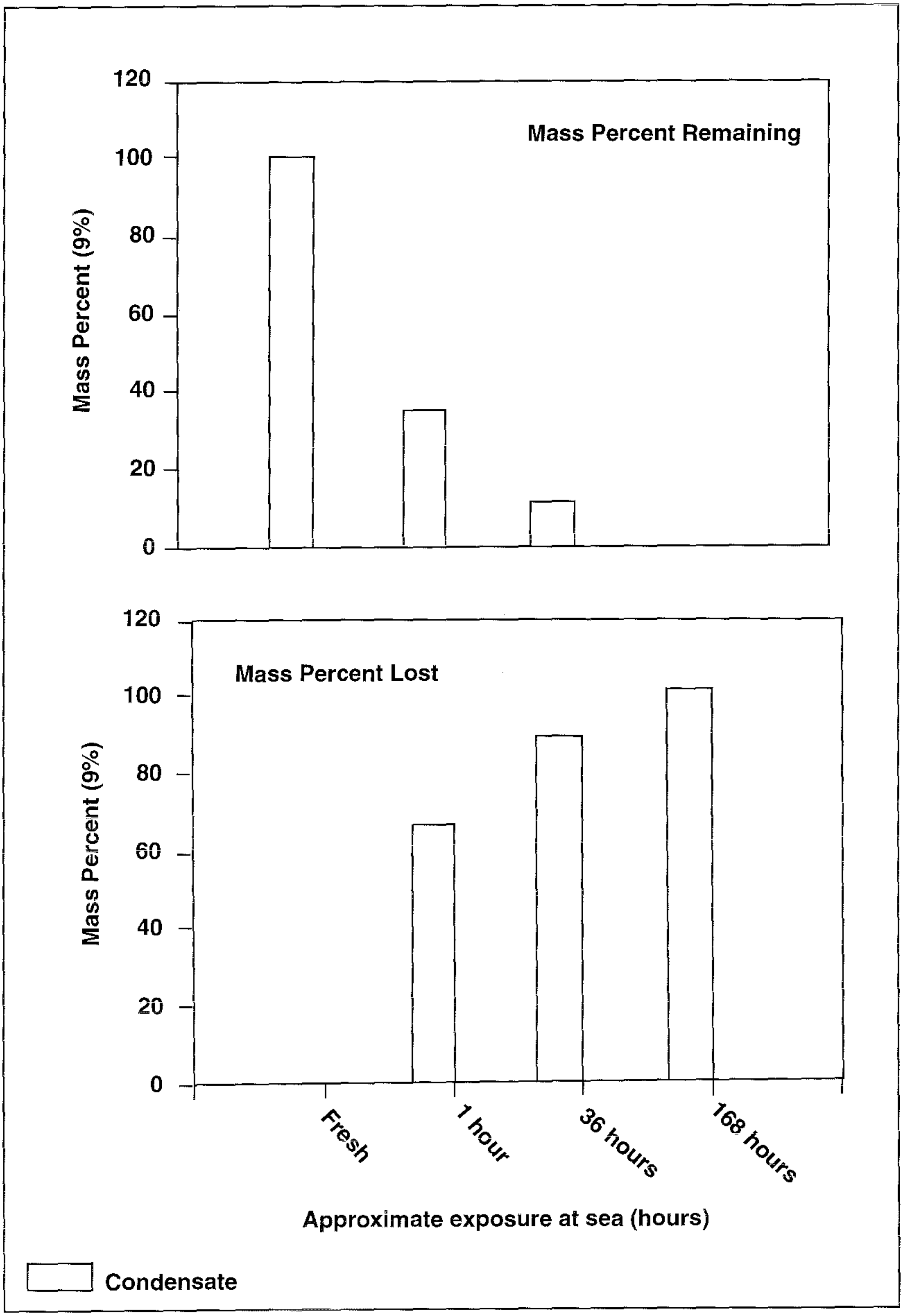

Figure 3. Evaporation rate of Wonnich condensate at 20°C. (Source: Laboratory testing by Batelle Corp. for Apache Energy Ltd).

Appendix 2

List of organisations which made submissions

Commonwealth Government Agencies

- Environment Australia Biodiversity Group
- Environment Australia Identification and Conservation Branch

State Government Agencies

- Department of Conservation and Land Management

Non-Government Organisation

- Conservation Council of Western Australia Inc.

Appendix 3

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Appendix 4

Draft conditions

WONNICH GAS DEVELOPMENT
SOUTH-WEST OF THE MONTEBELLO ISLANDS (1040)

APACHE NORTHWEST PTY LTD

This proposal may be implemented subject to the following conditions:

1 Proponent Commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Consultative Environmental Review and subsequently during the environmental assessment process conducted by the Environmental Protection Authority, provided that the commitments are not inconsistent with the conditions or procedures contained in this statement.

In the event of any inconsistency, the conditions and procedures shall prevail to the extent of the inconsistency.

The attached environmental management commitments form the basis for consideration by the Chief Executive Officer of the Department of Environmental Protection for auditing of this proposal in conjunction with the conditions and procedures contained in this statement.

2 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal.

2-2 Where, in the course of the detailed implementation referred to in condition 2-1, the proponent seeks to change the designs, specifications, plans or other technical material submitted to the Environmental Protection Authority in any way that the Minister for the Environment determines, on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 Proponent

These conditions legally apply to the nominated proponent.

3-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment 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 shall 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.

4 Environmental Management System

The proponent should exercise care and diligence in accordance with international best practice environmental management principles.

4-1 In order to manage the relevant environmental factors, to meet the environmental objectives in Environmental Protection Authority Bulletin 856, and to fulfil the requirements of the conditions and procedures in this statement, prior to implementation of the proposal, the proponent shall prepare environmental management system documentation with components such as those adopted in Australian Standards AS/NZS ISO 14000 series, to the requirements of the Environmental Protection Authority.

4-2 The proponent shall implement the environmental management system referred to in condition 4-1.

5 Location of Monopod and Pipeline

To avoid disturbance to coral "bommies" and other locally significant features, the proponent should carry out detailed seabed surveys to determine environmentally acceptable locations for the offshore structures.

5-1 Prior to contruction, the proponent shall determine suitable locations for the monopod and pipeline by means of detailed seabed surveys, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority, in consultation with the Department of Environmental Protection, the Department of Conservation and Land Management and the Department of Minerals and Energy.

5-2 The proponent shall construct the monopod and pipeline in locations according to the requirements of condition 5-1.

6 Shoreline Crossing

6-1 Prior to construction, the proponent shall determine the location of the shoreline crossing, to the requirements of the Minister for the Environment on advice of the Department of Conservation and Land Management.

6-2 The proponent shall construct the shoreline crossing to the requirements of condition 6-1.

6-3 Prior to construction, the proponent shall prepare a rehabilitation plan for the shoreline crossing and its environs, to the requirements of the Minister for the Environment on advice of the Department of Conservation and Land Management.

6-4 The proponent shall implement the rehabilitation plan required by condition 6-3.

7 Work Practices

7-1 Prior to commencement of drilling, the proponent shall prepare a written prescription for contractor work practices covering drilling, pipeline installation and support vessel operation, to ensure that work practices are carried out at the level of international best practice, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Minerals and Energy.

7-2 The proponent shall ensure that all drilling and pipeline works and support vessel operations comply with the prescription referred to in condition 7-1.

8 Decommissioning

8-1 The proponent shall carry out the decommissioning of the project, which includes the removal of the production monopod and may include the removal of the pipeline.

8-2 At least two years prior to decommissioning, the proponent shall prepare a decommissioning and rehabilitation plan to achieve the objectives of condition 8-1 to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy and the Department of Conservation and Land Management.

8-3 The proponent shall implement the plan required by condition 8-2.

9 Time Limit on Commencement

The environmental approval for the substantial commencement of the proposal is limited.

9-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period to the Minister for the Environment.

Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

10 Performance Review

The proponent should review their environmental performance to ensure that environmental management meets the environmental objectives and allows for continuous improvement.

10-1 Each five years following commencement of construction, the proponent shall carry out a performance review to evaluate environmental performance with respect to the environmental objectives, the performance indicators, and the environmental management system targets, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note:
The Environmental Protection Authority may recommend actions to the Minister for the Environment following consideration of the performance review.

11 Compliance Auditing

To help determine environmental performance and compliance with the conditions, periodic reports on the implementation of the proposal are required.

11-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Procedure

1 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

2 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

Note

1 The Environmental Protection Authority reported on the proposal in Environmental Protection Authority Bulletin 856 (June 1997).

2 The Department of Minerals and Energy will require the proponent to prepare an annexure to the existing approved oil spill contingency plan to detail the contingency measures applicable to a spill of condensate.

This annexure will be prepared to the requirements of the Department of Minerals and Energy on advice of the State Committee for Combating Marine Oil Pollution and the Department of Environmental Protection.

3 The Department of Minerals and Energy will require the proponent to take out adequate oil spill insurance to cover damages to third parties and the cost of oil spill clean-up operations, to meet the requirements of the Petroleum (Submerged Lands) Act.

4 The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

There is a specific requirement for a Works Approval for the deep disposal well.